

**Shadow Economies around the World:  
New Results for 158 Countries over 1991-2015**

by

Friedrich SCHNEIDER

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Johannes Kepler University of Linz  
Department of Economics  
Altenberger Strasse 69  
A-4040 Linz - Auhof, Austria  
[www.econ.jku.at](http://www.econ.jku.at)

[friedrich.schneider@jku.at](mailto:friedrich.schneider@jku.at)

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**Revised version**

# **Shadow Economies around the World: New Results for 158 Countries over 1991-2015**

by

Leandro Medina\*

and

Friedrich Schneider\*\*

## **Abstract:**

*This paper is a first attempt to estimate the size and development of the shadow economy of 158 countries over the period 1991 up to 2015. Using the Multiple Indicators, Multiple Causes (MIMIC) method we apply for the first time (i) the light intensity approach instead of GDP avoiding the problem that quite often GDP is used as a cause and indicator variable, (ii) the Predictive Mean Matching (PMM) method, and (iii) a variety of robustness tests. Results suggest that the average size of the shadow economy of these 158 countries over 1991-2015 is 32.5% of official GDP, which was 34.82% in 1991 and decreased to 30.66% in 2015. The lowest size of the shadow economy East Asian countries with 16.77% averaged over the period 1991-2015, then follows OECD countries with 18.7% and the highest value have Latin American and sub-Saharan African countries with values above 35%.*

**Keywords:** Shadow economies of 158 countries, MIMIC estimations, the light intensity approach, tax burden, regulation, trade openness, corruption.

**JEL-classifications:** C39, C51, C82, H11, H26, U17

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\* Dr. Leandro Medina, Economist, African Department, International Monetary Fund, E-mail: [lmolina@imf.org](mailto:lmolina@imf.org). The views expressed in this paper are those of the authors and do not necessarily represent those of the IMF or IMF policy.

\*\* Prof. Dr. Friedrich Schneider, Department of Economics, Johannes Kepler University of Linz, A-4040 Linz-Auhof, Tel.: 0043-732-2468-7340, Fax: 0043-732-2468-7341, E-mail: [friedrich.schneider@jku.at](mailto:friedrich.schneider@jku.at),

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# 1 Introduction

Up to now the shadow economy is by nature difficult to measure. Agents engaged in shadow economy activities try to stay undetected. The request for information of the extend of the shadow economy and its development over time is motivated by its political relevance. Moreover, the total economic activity, including official and unofficial production of goods and services is important in the design of economic policies that respond to fluctuations and economic development over time and across space. Furthermore, the size of the shadow economy is a core input to estimate the extend of tax evasion and thus for decisions on its adequate control.

Empirical research into the size and development of the global shadow economy has grown rapidly (Feld and Schneider 2010, Gerxhani 2003, Schneider 2011, 2015, Schneider and Williams 2013, Williams and Schneider 2016, and Hassan and Schneider 2016). The goals of this paper are the following:

(1) To present the latest shadow economy estimates for 158 countries all over the world over the period 1991 up to 2015 and to discuss the different developments.

(2) When using the MIMIC approach quite often it is a problem that GDP per capita or growth rate of GDP or first differences in GDP are quite often used as cause as well as indicator variables. Hence, we try to avoid these problems using the light intensity approach instead of the GDP as an indicator variable.

(3) There is a long and controversial discussion how to calibrate the relative MIMIC estimates of the shadow economy (compare Hashimzade and Heady (2016), Feige (2016), Schneider (2016) and Breusch (2016)). In this paper, we try a new way by using a fully independent method, the Predictive Mean Matching Method (PMM) by Rubin (1987), which overcomes these problems.

(4) We also run a variety of robustness tests to further assess the validity of our results, which include: comparing our estimates with those from countries national accounts.

To our knowledge this is one of the first attempts to include the light intensity approach at indicator variable and to use the PMM as an alternative methodology.

Generally, the shadow economy is known by different names, such as the hidden economy, grey economy, black economy or lack economy, cash economy or informal

economy. All these synonyms refer to some type of shadow economy activities. We use the following definition: The shadow economy includes all economic activities which are hidden from official authorities for various reasons. This varies from being monetary, to regulatory, to institutional reasons. Monetary reasons include avoiding paying taxes and all social security contributions, regulatory reasons, include avoiding governmental bureaucracy or the burden of regulatory framework while institutional reasons include corruption law quality of political institutions and weak rule of law. Given the purpose of our study, the shadow economy reflects mostly the legal economic and productive activities, that, if recorded, would contribute to national GDP, therefore the definition of the shadow economy in our study tries to avoid illegal or criminal activities, do-it-yourself, or other household activities.<sup>1</sup>

Our paper is organized as follows: In section 2 some theoretical considerations are drawn and discussing the most important cause variables and deriving the theoretically expected sign on the shadow economy. Then the use of indicator variables follows. Section 3 shortly discusses the methods to estimate the shadow economy with the MIMIC approach, and discusses the econometric results of the MIMIC estimations. Section 4 addresses shortcomings, introduces the use of night lights as proxy for the size of the economy and discusses additional robustness tests. Section 5 presents the results of the size of the shadow economy of the 158 countries. Section 6 summarizes and concludes.

## **2 Theoretical considerations**

Individuals are rational calculators who weigh up costs and benefits when considering breaking the law. Their decision to partially or completely participate in the shadow economy is a choice overshadowed by uncertainty, as it involves a trade-off between gains, if their activities are not discovered, and losses, if they are discovered and penalized. Shadow economic activities SE thus negatively depend on the probability of detection  $p$  and potential fines  $f$ , and positively on the opportunity costs of remaining formal denoted as  $B$ . The opportunity costs are positively determined by the burden of taxation  $T$  and high labor costs  $W$  – individual income

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<sup>1</sup> Of course, we are aware that there are overlapping areas, like prostitution, illegal construction firms, compare e.g. Williams and Schneider (2016).

generated in the shadow economy is usually categorized as labor income rather than capital income – due to labor market regulations. Hence, the higher the tax burden and labor costs, the more incentives individuals have to avoid these costs by working in the shadow economy. The probability of detection  $p$  itself depends on enforcement actions  $A$  taken by the tax authority and on facilitating activities  $F$  accomplished by individuals to reduce the detection of shadow economic activities. This discussion suggests the following structural equation:

$$SE = SE \left[ p \left( A, F \right); f; B \left( T, W \right) \right]$$

Hence, shadow economic activities may be defined as those economic activities and income earned that circumvent government regulation, taxation or observation. More narrowly, the shadow economy includes monetary and non-monetary transactions of a legal nature; hence all productive economic activities that would generally be taxable were they reported to the state (tax) authorities. Such activities are deliberately concealed from public authorities to avoid payment of income, value added or other taxes and social security contributions, or to avoid compliance with certain legal labor market standards such as minimum wages, maximum working hours, or safety standards and administrative procedures. The shadow economy thus focuses on productive economic activities that would normally be included in the national accounts, but which remain underground due to tax or regulatory burdens.<sup>2</sup> Although such legal activities would contribute to a country's value added, they are not captured in national accounts because they are produced in illicit ways. Informal household economic activities such as do-it-yourself activities and neighborly help are typically excluded from the analysis of the shadow economy.<sup>3</sup> What are the most important determinants influencing the shadow economy?

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<sup>2</sup> Although classical crime activities such as drug dealing are independent of increasing taxes and the causal variables included in the empirical models are only imperfectly linked (or causal) to classical crime activities, the footprints used to indicate shadow economic activities such as currency in circulation also apply for classic crime. Hence, macroeconomic shadow economy estimates do not typically distinguish legal from illegal underground activities; but instead represent the whole informal economy spectrum.

<sup>3</sup> From a social perspective, maybe even from an economic one, soft forms of illicit employment such as moonlighting (e.g. construction work in private homes) and its contribution to aggregate value added may be assessed positively. For a discussion of these issues, see Thomas (1992) and Buehn, Karmann and Schneider (2009).

## 2.1 Causes and Signs of Informality

The size of the informal economy depends on various elements. The literature highlights specific causes and indicators of the informal economy. Main causes:

- (i) *Tax burden and the size of government:* It is widely accepted by the literature that one of the most important causes leading to proliferation of informality is the tax burden, measured in this study by an index of fiscal freedom from the Heritage Foundation, which includes the top individual and corporate income tax, as well as the tax burden share of GDP. Additionally, this study also includes the Government consumption as a share of GDP, as one could expect that bigger government and a larger tax burden should encourage more economic activity to shift to the informal sector.
- (ii) *Institutional quality:* The World Bank produces a number of governance indicators, specifically: (a) the rule of law, (b) the control of corruption, and (c) government stability. In countries where the rule of law is respected and there is little corruption, businesses will understand the cost of operating in the formal economy, while lack of respect for the law or high corruption would encourage informal economic activity.
- (iii) *Trade Openness:* Trade as a share of GDP indicate market size and a country's openness to the world. As economies grow, it is likely to be more difficult to move economic activity from the formal to the informal sector. Furthermore, as international trade increases, it would be harder to hide trade from the authorities.

The size of the informal economy, commonly affects these indicators:

- (iv) *Monetary indicators:* People engaged in the informal economy usually conduct their activities in cash. Most shadow economy activities are, hence, reflected in additional use of cash. This indicator is captured in M0/M1, where the usual definition of M0 corresponds to the currency outside the banks and of M1 corresponds to M0 plus deposits.

- (v) *Labor force participation rate*: As more economic activity and workers shift to the informal economy, these workers would no longer show up as part of the labor force in national surveys.
- (vi) *Economic growth*: This study uses growth of GDP per capita. A larger informal economy would be associated with more economic activity moving out of the formal economy and would show as a decrease in economic growth.<sup>4</sup>

### **3 Estimation methods and MIMIC estimation results**

#### **3.1 Measuring the Informal Economy<sup>5</sup>**

This subsection describes the main methodologies used to measure the informal economy, highlighting their advantages and drawbacks.<sup>6</sup> These approaches can be divided into direct or indirect (including the model-based ones):

##### **3.1.1 Direct approaches**

The most common direct approaches to measuring the size of the informal economy rely on surveys and samples based on voluntary replies, or tax auditing and other compliance methods. While providing great detail about the structure of the informal economy, the results are sensitive to the way the questionnaire is formulated and respondents' willingness to cooperate. Consequently, surveys are unlikely to capture all informal activities.<sup>7</sup>

##### **3.1.2 Indirect approaches**

Indirect approaches, alternatively called "indicator" approaches, are mostly macroeconomic in nature. These are in part based on: the discrepancy between

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<sup>4</sup> Additionally, and to address criticism to the use of official GDP, in section 4 this study relies on data on light intensity from outer space as a proxy for the "true" economic growth achieved by countries. This approach has been also successfully used by Medina, Jonelis, and Cangul (2017) in the context of Sub-Saharan African countries.

<sup>5</sup> As there is available a huge literature about the various methods available to measure a shadow economy, a detailed overview about it as well as the problems using these methods (including the MIMIC method) are not discussed here. See e.g. Schneider and Enste (2002), Feld and Schneider (2010), Schneider, Buehn and Montenegro (2010), Schneider (2015), Schneider and Williams (2013), Williams and Schneider (2016).

<sup>6</sup> Based on Schneider and Este (2002), Feld and Schneider (2010), Williams and Schneider (2016).

<sup>7</sup> See Isanchen and Strom (1985), Witte (1987), Mogensen et al. (1995), and Feige (1996).



national expenditure and income statistics; the discrepancy between the official and actual labor force; the “electricity consumption” approach of Kauffman and Kaliberda (1996); the “monetary transaction” approach of Feige (1979); and the “currency demand” approach of Cagan (1958) among others; and the “Multiple Indicators, Multiple Causes” (MIMIC). Specifically:

- ***Discrepancy between national expenditure and income statistics:*** If those working in the informal economy were able to hide their incomes for tax purposes but not their expenditure, then the difference between national income and national expenditure estimates could be used to approximate the size of the informal economy. This approach assumes that all the components of the expenditure side are measured without error and constructed so that they are statistically independent from income factors.<sup>8</sup>
- ***Discrepancy between official and actual labor force:*** If the total labor force participation is assumed to be constant, a decline in official labor force participation can be interpreted as an increase in the importance of the informal economy. Since fluctuation in the participation rate might have many other explanations, such as the position in the business cycle, difficulty in finding a job and education and retirement decisions, but these estimates represent weak indicators of the size of the informal economy.<sup>9</sup>
- ***Electricity approach:*** Kaufmann and Kaliberda (1996) endorse the idea that electricity consumption is the single best physical indicator of overall (official and unofficial) economic activity. Using findings that indicate the electricity-overall GDP elasticity is close to one, these authors suggest using the difference between growth of electricity consumption and growth of official GDP as a proxy for the growth of the informal economy. This method is simple and appealing, but has many drawbacks, including: (i) not all informal economy activities require a considerable amount of electricity (e.g. personal services) or the use of other energy sources (like coal, gas, etc.), hence only

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<sup>8</sup> See for example MacAfee (1980), and Yoo and Hyun (1998).

<sup>9</sup> See for example Contini (1981), Del Boca (1981), and O'Neil (1983).

part of the informal economy growth is captured; and (ii) the electricity-overall GDP elasticity might significantly vary across countries and over time.<sup>10</sup>

- **Transaction approach:** Using Fischer's quantity equation,  $Money * Velocity = Prices * Transactions$ , and assuming that there is a constant relationship between the money flows related to transactions and the total (official and unofficial) value added, i.e.  $Prices * Transactions = k (official\ GDP + informal\ economy)$ , it is reasonable to derive the following equation  $Money * Velocity = k (official\ GDP + informal\ economy)$ . The stock of money and official GDP estimates are known, and money velocity can be estimated. Thus, if the size of the informal economy as a ratio of the official economy is known for a benchmark year, then the informal economy can be calculated for the rest of the sample. Although theoretically attractive, this method has several weaknesses, for instance: (i) the assumption of  $k$  constant over time seems quite arbitrary; and (ii) other factors like the development of checks and credit cards could also affect the desired amount of cash holdings and thus velocity.<sup>11</sup>
- **Currency demand approach:** Assuming that informal transactions take the form of cash payments, in order not to leave an observable trace for the authorities, an increase in the size of the informal economy will, consequently, increase the demand for currency. To isolate this "excess" demand for currency, Tanzi (1980) suggests using a time series approach in which currency demand is a function of conventional factors, such as the evolution of income, payment practices and interest rates, and factors causing people to work in the informal economy, like the direct and indirect tax burden, government regulation and the complexity of the tax system. However, there are several problems associated with this method and its assumptions: (i) this procedure may underestimate the size of the informal economy, because not all transactions take place using cash as means of exchange; (ii) increases in currency demand deposits may occur because of a slowdown in demand deposits rather than an increase in currency used in informal activities; (iii) it

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<sup>10</sup> See for example Del Boca and Forte (1982), Portes (1996) and Johnson et al. (1997).

<sup>11</sup> See for example Feige (1979), Boeschoten and Fase (1984) and Langfeldt (1984).

seems arbitrary to assume equal velocity of money in both types of economies; and (iv) the assumption of no informal economy in a base year is arguable.<sup>12</sup>

- **Multiple Indicators, Multiple Causes (MIMIC) approach:** This method explicitly considers several causes, as well as the multiple effects, of the informal economy. The methodology makes use of the associations between the observable causes and the effects of an unobserved variable, in this case the informal economy, to estimate the variable itself (Loayza, 1996).<sup>13</sup> This methodology is described in detail in subchapter 3.2.

### 3.2 MIMIC approach

The MIMIC model is a special type of structural equation modelling (SEM) that is widely applied in psychometrics and social science research and is based on the statistical theory of unobserved variables developed in the 1970s by Zellner (1970) and Joreskog and Goldberger (1975). The MIMIC model is a theory-based approach to confirm the influence of a set of exogenous causal variables on the latent variable (shadow economy), and also the effect of the shadow economy on macroeconomic indicator variables. At first, it is important to establish a theoretical model explaining the relationship between the exogenous variables and the latent variable. Therefore, the MIMIC model is considered to be a confirmatory rather than an explanatory method. The hypothesized path of the relationships between the observed variables and the latent shadow economy based on our theoretical considerations is depicted in the following Figure 3.1. The pioneers to apply the MIMIC model to measure the size of the shadow economy in 17 OECD countries were Frey et al. (1984). Following them, various scholars like Schneider et al.(2010), Hassan et al. (2016), and Buehn et al. (2009) applied the MIMIC model to measure the size of the shadow economy. Formally, the MIMIC model has two parts: the structural model and the measurement model. The structural model shows that the latent variable is linearly determined by a set of exogenous causal variables which can be illustrated as follows:

$$\eta = \gamma' \chi + \zeta \tag{1}$$

<sup>12</sup> See for example Cagan (1958), Gutmann (1977), Tanzi (1980, 1983), Schneider (1997) and Johnson et al. (1998).

<sup>13</sup> See Schneider (2010, 2015) Feld and Schneider (2010), Abdih and Medina (2016), Vuletin (2008), and Williams and Schneider (2016).

Where,

$\chi$  is a vector of causal variables,  $\gamma$  is a vector of scalars,  $\eta$  is the latent variable (shadow economy) and  $\zeta$  is a structural disturbance term.

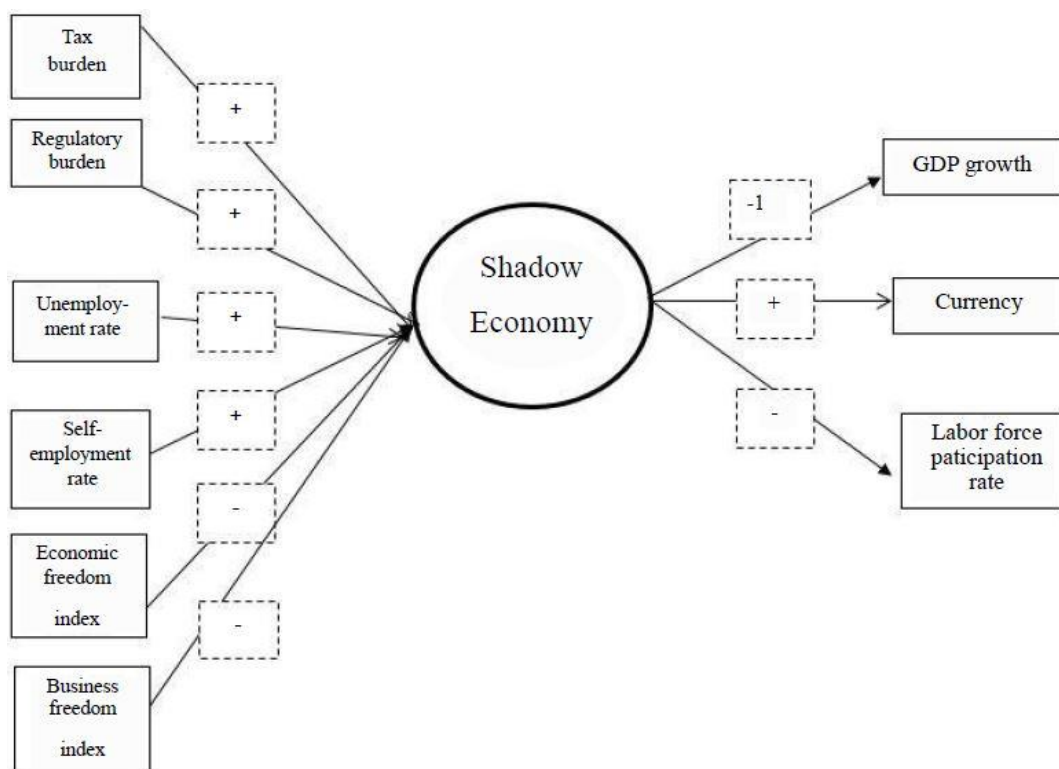
The measurement model which links the shadow economy with the set of selected indicators is specified by:

$$y = \lambda\eta + \varepsilon \quad (2)$$

Where,  $y$  is a vector of indicator variables, and  $\lambda$  is a vector of loading factors to represent the magnitude of the expected change for a unit change in the latent variable  $\eta$ . The  $\varepsilon$  is the measurement error term.

The MIMIC model simultaneously takes into account different causes and indicators that directly influence the development of the size of the shadow economy over time.

**Figure 3.1: Hypothesized MIMIC path for estimating the shadow economy**



### **3.3 MIMIC estimation results**

In tables 3.1 to 3.3, which include six specifications per table, the MIMIC estimation results over the period 1991-2015 for 158 countries (maximum sample) are presented.<sup>14</sup> Table 3.1 contains the estimation results for all countries. All cause variables (trade openness, unemployment, size of government, fiscal freedom, rule of law, control of corruption, government stability, have the theoretically expected signs, and most of them are highly statistically significant. Also the indicator variables have the theoretical expected signs and are highly statistically significant. The test statistics are satisfactory.

Table 3.2 contains the estimation results of 105 developing countries (maximum sample). Here the cause variable rule of law is not statistically significant in specification 1, as well as control of corruption in specification 2. These variables are significant and with the expected sign in the other specifications. The indicator variable labor force is again highly statistically significant.

Finally, results for 26 advanced countries are presented in table 3.3. Here trade openness is not in all specifications statistically significant, but in all other specifications most cause variables have the expected sign and are statistically significant, except government stability and size of government.<sup>15</sup> The indicator variables are all statistically significant and have the expected signs.

## **4 Addressing Potential Shortcomings**

### **4.1 Night Lights Intensity Approach**

Even though the standard MIMIC model a la Schneider (2010) has been widely used by the literature for many years, it has also been subject of criticism. Mainly on: (i) the use of GDP (GDP per capita and growth of GDP per capita) and cause and indicator variables, (ii) the

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<sup>14</sup> The MIMIC regression includes 151 countries. This estimation generated the coefficients and standard deviations. Following this, during the calibration phase, eight countries were dropped as the time series were not long enough, Specifically, Afghanistan, Macao, Macedonia, Serbia, St. Lucia, St. Vincent and the Grenadines, Sudan, and Tonga. Moreover, for 15 additional countries availability on the drivers' information permitted the estimation of the informal economy, and therefore, were added to the sample. Specifically, Austria, Belgium, Ethiopia, Finland, France, Germany, Greece, Ireland, Italy, Mauritania, Netherlands, Niger, Rwanda, Togo, and United Kingdom. This completes the list of 158 countries with shadow economy estimates (Table 3, specification 1).

<sup>15</sup> This is intuitive, as in advanced countries one would expect already good institutions.

fact that the methodology relies on another independent study to calibrate from standardized values to size of informal economy in percent of GDP, and (iii) the estimated coefficients are sensitive to alternative specifications, the country sample and time span chosen. Points (ii) and (iii) will not be discussed in our paper; they are extensively discussed in Schneider (2016).

We address the main criticism of (i) as follows:

Instead of using GDP per capita and growth of GDP per capita as cause and indicator variables, we use the night lights approach by Henderson, Storeygard, and Weil (2012) to independently capture economic activity. In their paper, they use data on light intensity from outer space as a proxy for the “true” economic growth achieved by countries. They also use the estimated elasticity of light intensity with respect to economic growth to produce new estimates of national output for countries deemed to have low statistical capacity. Therefore, by using the night lights approach we address MIMIC criticisms related to the endogeneity of GDP in a novel way, which is totally independent from problematic GDP measures traditionally used.

#### **4.2 Estimation Results using the Night Lights Intensity Approach**

In tables 4.1 to 4.3, which include five alternative specifications per table, the MIMIC estimation results over the period 1991-2015 different country samples depending on data availability. Table 4.1 contains the estimation results for all countries, and uses as one indicator variable, the light intensity. All cause variables (trade openness, unemployment, size of government, fiscal freedom, rule of law, control of corruption, government stability, have the theoretically expected signs, and most of them are highly statistically significant, except control of corruption. Also the indicator variables have the theoretical expected signs and are highly statistically significant. The test statistics are satisfactory.

Table 4.2 contains the estimation results of 103 developing countries. Here the cause variable unemployment is not statistically significant as well as rule of law and control of corruption. The indicator variable labor force is again highly statistically significant.

Considering the 24 advanced countries the results are presented in table 4.3. Here trade openness is not in all specifications statistically significant, but in all other specifications most cause variables are statistically significant, except government stability. The indicator variables are all statistically significant and have the expected signs.

### 4.3 An alternative procedure: Predictive Mean Matching

Predictive Mean Matching (PMM), (Rubin, 1987) treats the empirical challenge in the estimation of the size of the informal economy as a missing data problem: for some countries, we have survey-based estimates of the size of the informal economy,<sup>16</sup> for others, it is missing.

Missing data can result from three types of mechanisms: missing completely at random (MCAR), missing at random (MAR) or missing not at random (MNAR), (Little and Rubin, 1987). The PMM analysis assumes that for the informal economy, the mechanism is MAR. This means the following: the probability that an observation is missing can depend on observed co-variables of non-missing units and missing units, but it cannot depend on missing data, the size of the informal economy. In other words, we are assuming that the probability that a country is missing data on its informal economy can depend on characteristics relevant for the informal economy, but the size of the informal economy itself should not be a factor. This assumption can be challenged because one can argue that a large informal economy would be difficult to measure, resulting in missing data. Furthermore, a large informal economy can be associated with institutional weaknesses that would make it also less likely to be measured due to capacity constraints. However, when we look at the survey data available, we see that there are data available for large informal economies as well, such as Niger and Burundi. Therefore, at least in practice, the MAR assumption is somewhat validated, but would have to be checked through sensitivity analyses that would operate under MNAR.

The objective is to match the countries where data exist to the those where data are missing using characteristics that would be relevant to the size of the informal economy.

One of the challenges inherent in the empirical problem of estimating the size of the informal economy is that, for many countries, this is hard to estimate due to institutional capacity constraints. The informal economy is complex, encompassing many related factors that in any estimation procedure may produce problems of endogeneity and other empirical challenges. A principal constraint in this exercise is that those countries for which some estimation of the informal economy is available

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<sup>16</sup> There were 49 countries that were identified to have survey-based estimates of the size of their informal economies, including 9 in Sub-Saharan Africa.

are not very similar to countries where this is missing, incidentally, the very countries where we are trying to produce an estimate in Sub-Saharan Africa.

Predictive Mean Matching (PMM) circumvents this challenge somewhat by producing multiple datasets using its Bayesian setup. Therefore, where we lack the data for similar countries, the method is able to compensate by taking advantage of the inherent uncertainty associated with a missing data problem.

The other advantage of the PMM method is that in its actual estimation step, it is non-parametric. It does not suffer from any of the problems associated with a regular regression method in which dissimilar countries would be estimated using the same co-variates, and assuming linear extrapolations across co-variate distributions that may be different and far apart from each other. The principle of similarity in PMM avoids this fundamental problem: it matches countries lacking data to countries that have the data based on their similarity. But how is this similarity itself estimated? This is the crux of the methodology. Similar to PMM, Propensity Score Matching (PSM) is also a promising candidate. However, the constraint with PSM in this case is that not enough similar observations are matched to be able to then run separate regressions or even make non-parametric estimates for each group due to the number of estimations that are necessary to make.

The similarity principle for PMM is established using a linear regression. Here, we estimate the following simple OLS model:

$$Y_{it} = \alpha + \beta_{geo} * GE_0 + \beta_{rq} * RQ + \beta_c * C + \beta_{rol} * \beta * ROL + \beta_{bf} * BF + \beta_{se} * SE + \beta_{HDI} * HDI + \beta_E * E$$

Where Y is the size of the informal economy as percent of GDP, GE is government effectiveness index, RQ is a regulatory quality index, C is a corruption index, ROL is a rule of law index, BF is a business freedom index, SE is self-employment levels, HDI is the Human Development Index, and E is an education variable.

The distinctive feature of the PMM is that this regression is not actually used for the estimation of the size of the informal economy, but rather as a matching tool. For this we have the following eight stages that are computed using the SAS Proc MI procedure<sup>17</sup>:

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<sup>17</sup> SAS, STAT 14.1 User's Guide The MI Procedure, SAS Institute, 2015.



A random draw is made from the posterior predictive distribution of the estimated co-variate coefficient matrix  $\beta_{\cdot}$ , resulting in a new co-variate coefficient matrix  $\beta_{\cdot}^*$ .

Using  $\beta_{\cdot}^*$ , we predict  $Y^*$  for all countries.

The algorithm then identifies countries where we had actual  $Y_i$  and whose predicted  $Y^*$ , are closest to the predicted  $Y^*$  of the countries missing the data. Hence we have matches between  $Y^*_{\text{jobs}}$  and  $Y^*_{\text{imiss}}$ : predicted values for the outcome variable originally missing and originally having an estimate of the size of the informal economy.

Each country missing the data is assigned to a group that has similar countries having the data from the previous procedure.

In each group, the MI algorithm randomly selects a match to the countries originally missing the outcome, and assigns the observed outcome from the match to be the estimated outcome variable for the country missing the outcome.

Steps 1-5 are repeated five times, generating five distinct datasets with imputed values of the informal economy, mimicking the variability inherent due to the uncertainty associated with the missing data mechanism.

To produce a final estimate, we take the average of the five datasets for the size of the informal economy.<sup>18</sup>

The results are consistent with the rankings produced by the MIMIC method (not shown here), with Spearman's rank correlation at 61 percent and significant at one percent statistic significance. Furthermore, when the MIMIC and PMM samples are divided into three subgroups countries, specifically of "lower than 20 percent of GDP," "between 20 and 40 percent of GDP," "higher than 40 percent of GDP," most countries coincides between samples (over 60 percent).

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<sup>18</sup> Here, we can of course weigh these datasets based on a separate estimation procedure that would give certain "matches" more weight. For example, we could separately estimate a propensity score for each country, and use the propensity scores to weigh the matches in each dataset. For simplicity, in this paper, we use a simple average.

#### **4.4 Additional Robustness Test: Excluding GDP and GDP per capita from the regressions**

This section further tests the robustness of the results by fully removing the effects of GDP, by dropping both GDP per capita as cause and growth of GDP per capita as indicator.

The results are presented in tables 4.4 to 4.6, which include six alternative specifications per table, the MIMIC estimation results over the period 1991-2015 for different country samples depending on data availability. These results are consistent with those in the previous sections.

### **5 Results of the Size of the Shadow Economy of 158 Countries**

In table 5.1 the most important results of the 158 countries listed in alphabetical order are shown<sup>19</sup>. The average value of the size of the shadow economy of the 158 countries is 32.3. The average median is 32.7 and shows that both values are quite close to each other, so there is not such a strong deviation. The three highest shadow economies have Zimbabwe with 60.6, Bolivia with 62.3 and Georgia with 64.9. The three lowest shadow economies have Austria with 9.9, the United States with 9.4 and Switzerland with 9. The average shadow economy comes close to Mauritania and the Dominican Republic which both also have a shadow economy of 32.3% of official GDP.

In figures 5.1 and 5.2 some disaggregated results are shown. Figure 5.1 presents the shadow economy by region; the OECD countries are by far the lowest with an average value of 20% and the Sub-Saharan African countries the highest with an average value of 39% (both averages over 1991-2015). In all country groups we have a significant decline of the size of the shadow economy over time; average decline from 1991 to 2015 5.3 percentage points. Figure 5.2 presents the results grouped by income. High income countries have the lowest shadow economy and low income countries vice versa.

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<sup>19</sup> For a detailed presentation of the results over all countries and over all years see Table A.1 of the Appendix.

## **6 Summary and Concluding Remarks**

### **6.1 Summary**

In this paper we undertake a first attempt to estimate the size and development of the shadow economies of 158 countries over the period 1991 to 2015 by using different methods and alternative specifications. Using a MIMIC method we apply for the first time (i) the light intensity approach instead of GDP avoiding the problem that quite often GDP is used as a cause and indicator variable, we also use (ii) the PMM methodology which provides robust results and confirms those of the MIMIC.

The additional robustness tests also clearly show that in most cases trade openness, unemployment rate, GDP per capita, size of government, fiscal freedom, control of corruption are highly statistically significant. The results are robust when using the light intensity approach. Results are also robust to dropping GDP and GDP per capita, again the results show that trade openness unemployment rate, size of government, fiscal freedom, rule of law and corruption are statistically significant. This holds also for the sub-samples. Hence, these two kinds of robustness tests demonstrate that the MIMIC results lead to quite robust results.

### **6.2 What type of policy conclusions can we draw from these results?**

1. The MIMIC estimations of the 158 countries over 1991 to 2015 produce quite stable results which are comparable to Schneider (2010), Hassan and Schneider (2016) and other studies.
2. Using as an indicator variable the light intensity approach proved to be an alternative instead of GDP per capita or GDP growth rate. Hence, if we have more or better data from this variable it might be used as an indicator.
3. In order to avoid the problems of calibrating the relative estimates of the MIMIC methodology we used a new method, the Predict Mean Matching one, developed by Rubin (1987). This method produced quite plausible results and avoids the problems one has with the usual calibration methods done in Schneider (2010), Hassan and Schneider (2016) and in other papers.
4. Over all, we again find one stable result, a declining size and development of the shadow economy from 1991 to 2015. The continuous decline is only interrupted in the year 2008 due to the world economic crisis.

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## Tables and Figures

**Table 3.1: MIMIC Model Estimation Results: 1991-2015, All Countries**

|                                | 1         | 2         | 3         | 4         | 5         | 6         |
|--------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Causes                         |           |           |           |           |           |           |
| Trade Openess                  | -0.086*** | -0.085*** | -0.137*** | -0.086*** | -0.086*** | -0.113*** |
| GDP per capita                 | -0.332*** | -0.335*** | -0.37***  | -0.298*** | -0.302*** | -0.334*** |
| Unemployment Rate              | 0.051**   | 0.054***  | 0.069***  | 0.053**   | 0.057***  | 0.069***  |
| Size of Government             | 0.102***  | 0.102***  | 0.111***  |           |           |           |
| Fiscal Freedom                 |           |           |           | -0.131*** | -0.134*** | -0.147*** |
| Rule of Law                    | -0.049*** |           |           | -0.06***  |           |           |
| Control of Corruption          |           | -0.042*** |           |           | -0.046**  |           |
| Government Stability           |           |           | -0.054*** |           |           | -0.015    |
| Indicators                     |           |           |           |           |           |           |
| Currency                       | 1         | 1         | 1         | 1         | 1         | 1         |
| Labor Force Participation Rate | -0.521*** | -0.532*** | -0.31***  | -0.452*** | -0.468*** | -0.249*** |
| Growth of GDP per capita       | -0.208**  | -0.245*** | -0.386*** | -0.113    | -0.144*   | -0.157*** |
| Statistical Tests              |           |           |           |           |           |           |
| RMSEA                          | 0.073     | 0.073     | 0.067     | 0.078     | 0.078     | 0.055     |
| Chi-square                     | 513.407   | 506.43    | 649.062   | 508.189   | 500.667   | 535.332   |
| Observations                   | 1897      | 1892      | 2350      | 1758      | 1757      | 1998      |
| Countries                      | 151       | 151       | 122       | 144       | 144       | 120       |

Source: Own calculations.

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 3.2: MIMIC Model Estimation Results: 1991-2015, Developing Countries**

|                                | 1         | 2         | 3         | 4         | 5         | 6         |
|--------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Causes                         |           |           |           |           |           |           |
| Trade Openess                  | -0.114*** | -0.111*** | -0.134*** | -0.117*** | -0.116*** | -0.131*** |
| GDP per capita                 | -0.282*** | -0.287*** | -0.337*** | -0.244*** | -0.245*** | -0.291*** |
| Unemployment Rate              | 0.062***  | 0.059***  | 0.074***  | 0.085***  | 0.085***  | 0.084***  |
| Size of Government             | 0.111***  | 0.112***  | 0.107***  |           |           |           |
| Fiscal Freedom                 |           |           |           | -0.12***  | -0.123*** | -0.121*** |
| Rule of Law                    | -0.026    |           |           | -0.046**  |           |           |
| Control of Corruption          |           | -0.029    |           |           | -0.039*   |           |
| Government Stability           |           |           | -0.059*** |           |           | -0.015    |
| Indicators                     |           |           |           |           |           |           |
| Currency                       | 1         | 1         | 1         | 1         | 1         | 1         |
| Labor Force Participation Rate | -0.499*** | -0.511*** | -0.464*** | -0.421*** | -0.441*** | -0.446*** |
| Growth of GDP per capita       | -0.442*** | -0.434*** | -0.545*** | -0.113    | -0.462*** | -0.433*** |
| Statistical Tests              |           |           |           |           |           |           |
| RMSEA                          | 0.084     | 0.087     | 0.068     | 0.087     | 0.086     | 0.062     |
| Chi-square                     | 309.936   | 306.792   | 471.032   | 302.157   | 297.42    | 387.446   |
| Observations                   | 1309      | 1304      | 1687      | 1206      | 1205      | 1406      |
| Countries                      | 105       | 105       | 84        | 98        | 98        | 82        |

Source: Own calculations.

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 3.3: MIMIC Model Estimation Results: 1991-2015, Advanced Countries**

|                                | 1         | 2            | 3          | 4         | 5         | 6         |
|--------------------------------|-----------|--------------|------------|-----------|-----------|-----------|
| Causes                         |           |              |            |           |           |           |
| Trade Openess                  | 0.022     | 0.031        | -.16139*** | 0.013     | 0.025     | -0.084    |
| GDP per capita                 | -0.6***   | -0.641***    | -0.559***  | -0.494*** | -0.534*** | -0.474*** |
| Unemployment Rate              | 0.099**   | 0.089*       | 0.104**    | 0.056     | 0.043     | 0.049     |
| Size of Government             | -0.151*** | -0.158***    | -0.122**   |           |           |           |
| Fiscal Freedom                 |           |              |            | -0.138*** | -0.166*** | -0.168*** |
| Rule of Law                    | -0.026    |              |            | -0.084*   |           |           |
| Control of Corruption          |           | -0.0972094** |            |           | -0.126*** |           |
| Government Stability           |           |              | -0.0182766 |           |           | -0.015    |
| Indicators                     |           |              |            |           |           |           |
| Currency                       | 1         | 1            | 1          | 1         | 1         | 1         |
| Labor Force Participation Rate | -0.618*** | -0.606***    | -0.319***  | -0.582*** | -0.571*** | -0.259*** |
| Growth of GDP per capita       | 0.279*    | 0.252*       | 0.104      | -0.113    | 0.114     | 0.189*    |
| Statistical Tests              |           |              |            |           |           |           |
| RMSEA                          | 0.103     | 0.102        | 0.117      | 0.079     | 0.081     | 0.083     |
| Chi-square                     | 159.688   | 164.678      | 197.819    | 144.259   | 152.109   | 147.31    |
| Observations                   | 274       | 274          | 416        | 265       | 265       | 359       |
| Countries                      | 26        | 26           | 25         | 25        | 25        | 22        |

Source: Own calculations.

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 4.1. MIMIC Model Estimation Results (night lights instead of GDP): All Countries**

|                                | 1         | 2         | 3         | 4         | 5         | 6         |
|--------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Causes                         |           |           |           |           |           |           |
| Trade Openess                  | -0.172*** | -0.167*** | -0.106*** | -0.178*** | -0.175*** | -0.161*** |
| Unemployment Rate              | 0.062**   | 0.061**   | 0.008     | 0.067**   | 0.068**   | 0.056**   |
| Size of Government             | 0.106***  | 0.101***  | 0.036*    |           |           |           |
| Fiscal Freedom                 |           |           |           | -0.15***  | -0.153*** | -0.162*** |
| Rule of Law                    | -0.065**  |           |           | -0.068**  |           |           |
| Control of Corruption          |           | -0.026    |           |           | -0.035    |           |
| Government Stability           |           |           | -0.183*** |           |           | -0.132*** |
| Indicators                     |           |           |           |           |           |           |
| Currency                       | 1         | 1         | 1         | 1         | 1         | 1         |
| Labor Force Participation Rate | -0.457*** | -0.503*** | -0.478*** | -0.226*   | -0.244*   | -0.23**   |
| Lights (GDP)                   | -0.346*** | -0.372*** | -1.838*** | -0.275*** | -0.289*** | -0.661*** |
| Statistical Tests              |           |           |           |           |           |           |
| RMSEA                          | 0.023     | 0.027     | 0.079     | 0.052     | 0.053     | 0.082     |
| Chi-square                     | 125.015   | 116.891   | 548.593   | 158.781   | 151.93    | 307.091   |
| Observations                   | 1341      | 1336      | 1767      | 1211      | 1210      | 1498      |
| Countries                      | 148       | 148       | 120       | 139       | 139       | 116       |

Source: Own calculations.

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1



**Table 4.2. MIMIC Model Estimation Results (night lights instead of GDP):  
Developing Countries**

|                                | 1         | 2         | 3         | 4         | 5         | 6         |
|--------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Causes                         |           |           |           |           |           |           |
| Trade Openess                  | -0.159*** | -0.155*** | -0.076*** | -0.139*** | -0.136*** | -0.08***  |
| Unemployment Rate              | 0.029     | 0.029     | -0.007    | 0.047     | 0.047     | 0.006     |
| Size of Government             | 0.094**   | 0.092**   | 0.026*    |           |           |           |
| Fiscal Freedom                 |           |           |           | -0.129*** | -0.128*** | -0.104*** |
| Rule of Law                    | -0.021    |           |           | -0.009    |           |           |
| Control of Corruption          |           | -0.004    |           |           | -0.009    |           |
| Government Stability           |           |           | -0.192*** |           |           | -0.164*** |
| Indicators                     |           |           |           |           |           |           |
| Currency                       | 1         | 1         | 1         | 1         | 1         | 1         |
| Labor Force Participation Rate | -0.419**  | -0.427**  | -0.518*** | -0.311*   | -0.313*   | -0.323**  |
| Lights (GDP)                   | -0.636*** | -0.657*** | -2.389*** | -0.694*** | -0.704*** | -1.426*** |
| Statistical Tests              |           |           |           |           |           |           |
| RMSEA                          | 0.01      | 0.014     | 0.072     | 0.04      | 0.04      | 0.073     |
| Chi-square                     | 89.64     | 87.74     | 527       | 113.669   | 110.397   | 290.032   |
| Observations                   | 957       | 952       | 1304      | 850       | 849       | 1088      |
| Countries                      | 103       | 103       | 83        | 96        | 96        | 80        |

Source: Own calculations.

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 4.3. MIMIC Model Estimation Results (night lights instead of GDP):  
Advanced Countries**

|                                | 1         | 2        | 3          | 4         | 5         | 6        |
|--------------------------------|-----------|----------|------------|-----------|-----------|----------|
| Causes                         |           |          |            |           |           |          |
| Trade Openess                  | 0.132     | 0.204**  | 0.229***   | 0.075     | 0.108     | 0.174**  |
| Unemployment Rate              | -0.352*** | -0.36*** | -0.41***   | -0.3***   | -0.295*** | -0.34*** |
| Size of Government             | -0.098    | -0.158*  | -0.165**   |           |           |          |
| Fiscal Freedom                 |           |          |            | -0.247*** | -0.293*** | -0.23*** |
| Rule of Law                    | -0.24***  |          |            | -0.186**  |           |          |
| Control of Corruption          |           | -0.117*  |            |           | -0.092    |          |
| Government Stability           |           |          | -0.064     |           |           | 0.024    |
| Indicators                     |           |          |            |           |           |          |
| Currency                       | 1         | 1        | 1          | 1         | 1         | 1        |
| Labor Force Participation Rate | -0.329*   | -0.363*  | -0.462***  | -0.308*   | -0.329**  | -0.316** |
| Lights (GDP)                   | 0.467**   | 0.366*   | -0.0661817 | 0.553***  | 0.51***   | 0.381**  |
| Statistical Tests              |           |          |            |           |           |          |
| RMSEA                          | 0.068     | 0.067    | 0.122      | 0.052     | 0.056     | 0.086    |
| Chi-square                     | 76.456    | 64.922   | 136.547    | 89.16     | 82.642    | 113.695  |
| Observations                   | 189       | 189      | 302        | 189       | 189       | 263      |
| Countries                      | 24        | 24       | 24         | 24        | 24        | 24       |

Source: Own calculations.

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 4.4: MIMIC Model Estimation Results (Excluding GDP and GDP per capita), All Countries**

|                                | 1         | 2         | 3         | 4         | 5         | 6         |
|--------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Causes                         |           |           |           |           |           |           |
| Trade Openess                  | -0.138*** | -0.133*** | -0.237*** | -0.133*** | -0.133*** | -0.19***  |
| Unemployment Rate              | 0.113***  | 0.115***  | 0.12***   | 0.099***  | 0.104***  | 0.125***  |
| Size of Government             | 0.073***  | 0.067**   | 0.086***  |           |           |           |
| Fiscal Freedom                 |           |           |           | -0.199*** | -0.209*** | -0.228*** |
| Rule of Law                    | -0.095*** |           |           | -0.095*** |           |           |
| Control of Corruption          |           | -0.041*   |           |           | -0.048*   |           |
| Government Stability           |           |           | -0.024    |           |           | 0.028     |
| Indicators                     |           |           |           |           |           |           |
| Currency                       | 1         | 1         | 1         | 1         | 1         | 1         |
| Labor Force Participation Rate | -0.642*** | -0.746*** | -0.48***  | -0.391*** | -0.416*** | -0.323*** |
| Statistical Tests              |           |           |           |           |           |           |
| RMSEA                          | 0.032     | 0.019     | 0.018     | 0.062     | 0.061     | 0.047     |
| Chi-square                     | 183.492   | 153.806   | 250.361   | 263.345   | 243.527   | 331.241   |
| Observations                   | 1901      | 1896      | 2329      | 1761      | 1760      | 1963      |
| Countries                      | 151       | 151       | 122       | 144       | 144       | 120       |

Source: Own calculations.

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 4.5: MIMIC Model Estimation Results: (Excluding GDP and GDP per capita), Developing Countries**

|                                | 1         | 2         | 3         | 4         | 5         | 6         |
|--------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Causes                         |           |           |           |           |           |           |
| Trade Openess                  | -0.125*** | -0.123*** | -0.189*** | -0.117*** | -0.116*** | -0.17***  |
| Unemployment Rate              | 0.099***  | 0.098***  | 0.092***  | 0.098***  | 0.099***  | 0.108***  |
| Size of Government             | 0.094***  | 0.091***  | 0.082**   |           |           |           |
| Fiscal Freedom                 |           |           |           | -0.174*** | -0.173*** | -0.196*** |
| Rule of Law                    | -0.028    |           |           | -0.041    |           |           |
| Control of Corruption          |           | 0.001     |           |           | -0.012    |           |
| Government Stability           |           |           | -0.068**  |           |           | 0.0026759 |
| Indicators                     |           |           |           |           |           |           |
| Currency                       | 1         | 1         | 1         | 1         | 1         | 1         |
| Labor Force Participation Rate | -0.587*** | -0.61***  | -0.568*** | -0.41***  | -0.44***  | -0.393*** |
| Statistical Tests              |           |           |           |           |           |           |
| RMSEA                          | 0.018     | 0.009     | 0.054     | 0.039     | 0.032     | 0.054     |
| Chi-square                     | 87.747    | 81.821    | 155.224   | 121.97    | 115.142   | 180.803   |
| Observations                   | 1309      | 1304      | 1670      | 1206      | 1205      | 1384      |
| Countries                      | 105       | 105       | 84        | 98        | 98        | 82        |

Source: Own calculations.

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 4.6: MIMIC Model Estimation Results: (Excluding GDP and GDP per capita),  
Advanced Countries**

|                                | 1         | 2         | 3         | 4         | 5         | 6         |
|--------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Causes                         |           |           |           |           |           |           |
| Trade Openess                  | -0.211*** | -0.231*** | -0.401*** | -0.151**  | -0.153**  | -0.251*** |
| Unemployment Rate              | 0.212***  | 0.222***  | 0.192***  | 0.145**   | 0.141**   | 0.174***  |
| Size of Government             | -0.105    | -0.132*   | -0.12*    |           |           |           |
| Fiscal Freedom                 |           |           |           | -0.231*** | -0.287*** | -0.258*** |
| Rule of Law                    | -0.18***  |           |           | -0.161**  |           |           |
| Control of Corruption          |           | -0.145**  |           |           | -0.169*** |           |
| Government Stability           |           |           | -0.008    |           |           | 0.036     |
| Indicators                     |           |           |           |           |           |           |
| Currency                       | 1         | 1         | 1         | 1         | 1         | 1         |
| Labor Force Participation Rate | -0.63***  | -0.683*** | -0.558*** | -0.596*** | -0.632*** | -0.528*** |
| Statistical Tests              |           |           |           |           |           |           |
| RMSEA                          | 0.07      | 0.072     | 0.095     | 0.064     | 0.067     | 0.116     |
| Chi-square                     | 78.546    | 75.321    | 150.647   | 93.674    | 98.075    | 134.892   |
| Observations                   | 274       | 274       | 408       | 265       | 265       | 351       |
| Countries                      | 26        | 26        | 25        | 25        | 25        | 25        |

Source: Own calculations.

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 5.1: Summary statistics of the shadow economies of 158 countries over 1999 to 2015**

| Country                  | ISO | Average | Stand. Dev. | Median | Minimum | Maximum |
|--------------------------|-----|---------|-------------|--------|---------|---------|
| Albania                  | ALB | 32.7    | 5.8         | 32.6   | 25.4    | 43.2    |
| Algeria                  | DZA | 30.9    | 5.6         | 29.6   | 24      | 38.9    |
| Angola                   | AGO | 44      | 6.6         | 46.3   | 34.5    | 55.4    |
| Argentina                | ARG | 24.1    | 2           | 24.4   | 20.8    | 27.2    |
| Armenia                  | ARM | 42.6    | 4.8         | 43.6   | 34.6    | 49.5    |
| Australia                | AUS | 14.1    | 1.6         | 13.4   | 12.1    | 17.8    |
| Austria                  | AUT | 9.9     | 0.6         | 9.9    | 8.7     | 11      |
| Azerbaijan               | AZE | 52.2    | 7.4         | 53.7   | 42.2    | 64.7    |
| Bahamas, The             | BHS | 33.5    | 5.1         | 35.6   | 26.2    | 39.5    |
| Bahrain                  | BHR | 19.3    | 1.4         | 19.2   | 16.6    | 22.5    |
| Bangladesh               | BGD | 33.6    | 3.3         | 35.1   | 27.2    | 37.1    |
| Belarus                  | BLR | 44.5    | 7.1         | 47.8   | 32.3    | 53.6    |
| Belgium                  | BEL | 23.6    | 1.3         | 23.4   | 21.6    | 25.8    |
| Belize                   | BLZ | 46.8    | 4.3         | 45.4   | 40.7    | 53.7    |
| Benin                    | BEN | 53.7    | 3.4         | 53.5   | 46.3    | 60.8    |
| Bhutan                   | BTN | 26.9    | 3.3         | 27.8   | 20.3    | 31.2    |
| Bolivia                  | BOL | 62.3    | 8.4         | 66.7   | 46      | 71.3    |
| Bosnia and Herzegovina   | BIH | 34.2    | 3.5         | 33.2   | 29.9    | 44.5    |
| Botswana                 | BWA | 30.3    | 4.5         | 31.4   | 22.1    | 36.4    |
| Brazil                   | BRA | 37.6    | 2.8         | 38.5   | 32.6    | 41.7    |
| Brunei Darussalam        | BRN | 29.8    | 1.2         | 29.8   | 27      | 31.8    |
| Bulgaria                 | BGR | 30.8    | 5.5         | 32.3   | 22.4    | 37.7    |
| Burkina Faso             | BFA | 38.4    | 4.9         | 38.8   | 29.6    | 44.9    |
| Burundi                  | BDI | 36.7    | 3.5         | 38     | 26.9    | 40      |
| Cabo Verde               | CPV | 35.8    | 5.8         | 36     | 29.2    | 47.2    |
| Cambodia                 | KHM | 46      | 6.8         | 45.4   | 33.9    | 56.7    |
| Cameroon                 | CMR | 32.4    | 2.3         | 32.5   | 28.1    | 37.9    |
| Canada                   | CAN | 17.5    | 2           | 16.8   | 15.5    | 22.1    |
| Central African Republic | CAF | 41.9    | 4.7         | 41.4   | 36.9    | 56      |
| Chad                     | TCD | 40.1    | 6           | 40.3   | 28.8    | 48.9    |
| Chile                    | CHL | 18.2    | 1.9         | 18.7   | 15.5    | 20.7    |
| China                    | CHN | 11.2    | 1.9         | 11.7   | 8.3     | 14.1    |
| Colombia                 | COL | 33.3    | 4.3         | 34.9   | 25.3    | 39.1    |
| Comoros                  | COM | 39.1    | 1.9         | 39.1   | 35.8    | 43.2    |
| Congo, Dem. Rep.         | COD | 46.4    | 1.8         | 46.5   | 41.1    | 49.3    |
| Congo, Rep.              | COG | 45.1    | 6.3         | 47.3   | 33.2    | 52.9    |
| Costa Rica               | CRI | 26.7    | 2.1         | 26.4   | 21.5    | 30.9    |
| Cote d'Ivoire            | CIV | 43.4    | 2.4         | 43.6   | 38.9    | 48.4    |

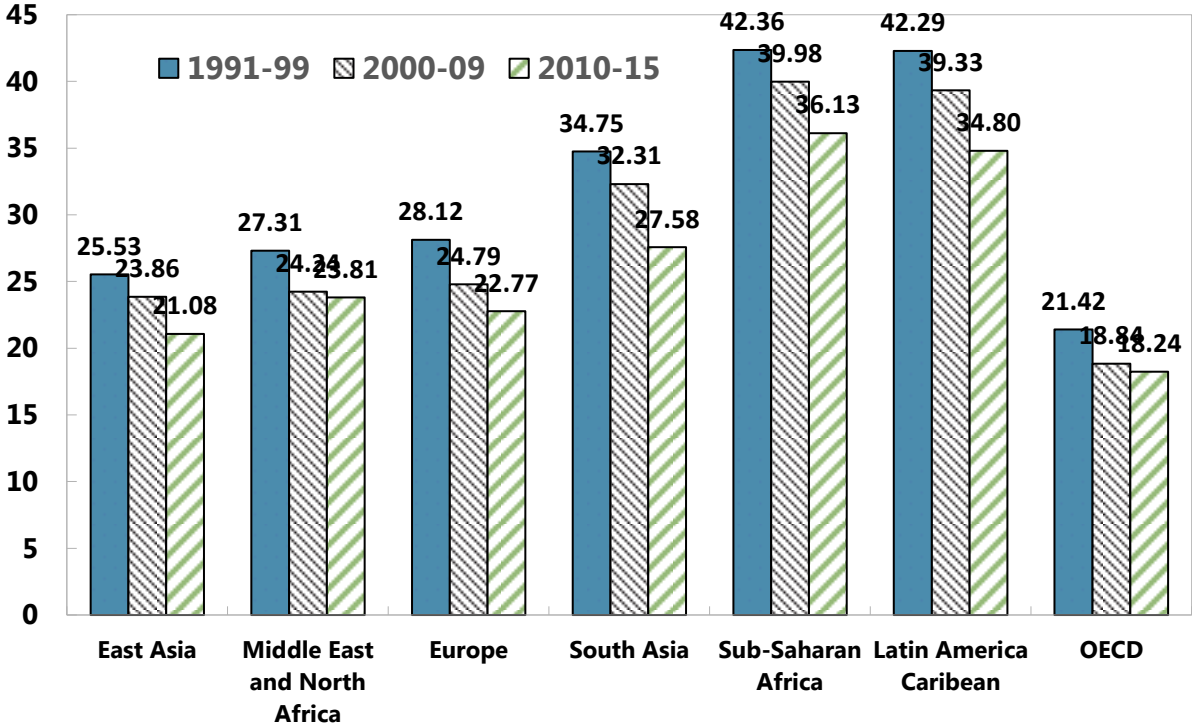
| Country              | ISO | Average | Stand. Dev. | Median | Minimum | Maximum |
|----------------------|-----|---------|-------------|--------|---------|---------|
| Croatia              | HRV | 30.3    | 4.9         | 28.5   | 23      | 38.7    |
| Cyprus               | CYP | 31.3    | 2.4         | 30.8   | 27.9    | 36.2    |
| Czech Republic       | CZE | 17.1    | 2.7         | 18.1   | 12.8    | 20.7    |
| Denmark              | DNK | 18.6    | 1.4         | 18.6   | 15.9    | 21.5    |
| Dominican Republic   | DOM | 32.3    | 2.2         | 32.3   | 27.6    | 35.8    |
| Ecuador              | ECU | 33.6    | 2.8         | 34.4   | 28.5    | 37      |
| Egypt, Arab Rep.     | EGY | 34.2    | 2.2         | 35.1   | 28.9    | 36.8    |
| El Salvador          | SLV | 45.6    | 3.9         | 44.7   | 40.1    | 53      |
| Equatorial Guinea    | GNQ | 31.8    | 3.3         | 31.4   | 27.2    | 38.1    |
| Eritrea              | ERI | 39.3    | 4.2         | 38.7   | 31.4    | 48.9    |
| Estonia              | EST | 28.8    | 4.3         | 29.6   | 22.5    | 35.5    |
| Ethiopia             | ETH | 34.3    | 5           | 36.4   | 24.5    | 40.3    |
| Fiji                 | FJI | 32.5    | 3.4         | 32.3   | 25.4    | 38.9    |
| Finland              | FIN | 19.1    | 1.9         | 18.6   | 16.5    | 22.7    |
| France               | FRA | 16      | 1.1         | 15.8   | 14      | 18.2    |
| Gabon                | GAB | 52.4    | 6.1         | 53.5   | 41.6    | 63.5    |
| Gambia, The          | GMB | 46.9    | 5.5         | 47.9   | 35.2    | 56.7    |
| Georgia              | GEO | 64.9    | 5.1         | 65.3   | 53.1    | 71.9    |
| Germany              | DEU | 15.6    | 1.4         | 15.9   | 13.3    | 17.7    |
| Ghana                | GHA | 42.9    | 2.6         | 42.6   | 38.5    | 47.7    |
| Greece               | GRC | 30.3    | 1.8         | 30.9   | 26.8    | 33      |
| Guatemala            | GTM | 54.7    | 4.9         | 53.5   | 46.9    | 63.9    |
| Guinea               | GIN | 39.9    | 1.8         | 39.7   | 37.4    | 43.9    |
| Guinea-Bissau        | GNB | 36.4    | 5.2         | 38.6   | 22      | 42.8    |
| Guyana               | GUY | 31.8    | 3.3         | 32.1   | 26      | 36.5    |
| Haiti                | HTI | 53.3    | 4           | 54.2   | 42.1    | 59.1    |
| Honduras             | HND | 46.3    | 4.3         | 47.4   | 37.7    | 53.7    |
| Hong Kong SAR, China | HKG | 14.7    | 1.8         | 15.4   | 11.9    | 17      |
| Hungary              | HUN | 25.2    | 4.2         | 24.1   | 20.4    | 33.7    |
| Iceland              | ISL | 15.8    | 1.1         | 15.8   | 14.1    | 17.6    |
| India                | IND | 20.3    | 3.5         | 21.2   | 14.3    | 24.8    |
| Indonesia            | IDN | 19.8    | 1.6         | 19.8   | 16.8    | 22.7    |
| Iran, Islamic Rep.   | IRN | 17.9    | 2.2         | 18.4   | 14.5    | 21.1    |
| Ireland              | IRL | 16.9    | 2           | 16     | 14.7    | 20.9    |
| Israel               | ISR | 22      | 1.7         | 22.3   | 19.4    | 25      |
| Italy                | ITA | 29.6    | 1.8         | 29     | 26.8    | 33.5    |
| Jamaica              | JAM | 34.1    | 2.1         | 34.8   | 30.4    | 36.9    |
| Japan                | JPN | 10.8    | 0.5         | 10.8   | 9.7     | 11.8    |
| Jordan               | JOR | 17.4    | 2.7         | 18.3   | 13.4    | 21.1    |
| Kazakhstan           | KAZ | 38.9    | 5.8         | 39.6   | 30.1    | 47.4    |
| Kenya                | KEN | 33.1    | 2.1         | 33.4   | 28.7    | 36.2    |

| Country          | ISO | Average | Stand. Dev. | Median | Minimum | Maximum |
|------------------|-----|---------|-------------|--------|---------|---------|
| Korea, Rep.      | KOR | 26.4    | 2.2         | 26.8   | 22.8    | 30      |
| Kuwait           | KWT | 19.3    | 1.8         | 19.7   | 15.7    | 22.1    |
| Kyrgyz Republic  | KGZ | 37.9    | 4.5         | 38     | 30      | 45.9    |
| Lao PDR          | LAO | 30.3    | 3.8         | 30.6   | 24.1    | 36.2    |
| Latvia           | LVA | 26      | 4.2         | 25.9   | 19.7    | 32.4    |
| Lebanon          | LBN | 31.6    | 3.5         | 33     | 24.6    | 36.7    |
| Lesotho          | LSO | 31.3    | 2.9         | 31.3   | 24.6    | 35.8    |
| Liberia          | LBR | 43.2    | 1.6         | 43     | 40      | 46.7    |
| Libya            | LBY | 33.6    | 3.9         | 34.9   | 25.9    | 38.8    |
| Lithuania        | LTU | 27.7    | 4.8         | 26.9   | 20.2    | 35.1    |
| Luxembourg       | LUX | 10.7    | 0.6         | 10.7   | 9.4     | 12      |
| Madagascar       | MDG | 42.6    | 2.4         | 41.7   | 38.7    | 47.4    |
| Malawi           | MWI | 38.5    | 2.3         | 38.8   | 33.6    | 43.7    |
| Malaysia         | MYS | 31.5    | 2.8         | 30.6   | 26.4    | 37.5    |
| Maldives         | MDV | 27.4    | 2.8         | 27.8   | 20.7    | 31.5    |
| Mali             | MLI | 38.7    | 4.9         | 39.6   | 29.5    | 45.3    |
| Malta            | MLT | 29.8    | 1.8         | 30.6   | 27      | 33.1    |
| Mauritania       | MRT | 32.3    | 4.8         | 33.4   | 24.4    | 38.6    |
| Mauritius        | MUS | 22.6    | 2.4         | 22.7   | 19.2    | 26.2    |
| Mexico           | MEX | 31.7    | 2.7         | 31     | 28.4    | 38.2    |
| Moldova          | MDA | 43.4    | 3.1         | 43.8   | 37.4    | 49.1    |
| Mongolia         | MNG | 17.3    | 2.5         | 17.7   | 12      | 21.1    |
| Morocco          | MAR | 34      | 4           | 34.7   | 27.1    | 40.4    |
| Mozambique       | MOZ | 37.2    | 5.1         | 36.6   | 30.1    | 46.9    |
| Myanmar          | MMR | 51.4    | 6.9         | 49.3   | 39.9    | 63.8    |
| Namibia          | NAM | 28.1    | 3.8         | 28.8   | 21.8    | 32.1    |
| Nepal            | NPL | 37.5    | 2.7         | 37.3   | 30.2    | 43.4    |
| Netherlands      | NLD | 14.2    | 1           | 14     | 13      | 16      |
| New Zealand      | NZL | 13.4    | 1.1         | 13.2   | 12      | 16.1    |
| Nicaragua        | NIC | 42.6    | 1.9         | 43     | 38.5    | 45.2    |
| Niger            | NER | 39.7    | 2.7         | 40.2   | 34.1    | 43.1    |
| Nigeria          | NGA | 56.3    | 4.8         | 57     | 44.5    | 66.6    |
| Norway           | NOR | 20.5    | 1.8         | 20.2   | 16.9    | 23.7    |
| Oman             | OMN | 19.9    | 2.1         | 19.9   | 15.5    | 23.9    |
| Pakistan         | PAK | 33.1    | 2.2         | 33.6   | 30.3    | 37.5    |
| Papua New Guinea | PNG | 34      | 4.2         | 35.1   | 23.3    | 42      |
| Paraguay         | PRY | 34.5    | 3           | 34.5   | 29.4    | 40.3    |
| Peru             | PER | 52.4    | 7.8         | 56.4   | 39.5    | 61      |
| Philippines      | PHL | 39.3    | 5.5         | 41.4   | 28      | 45.5    |
| Poland           | POL | 26.5    | 4.6         | 27.5   | 19.1    | 34.5    |
| Portugal         | PRT | 23.8    | 0.9         | 23.7   | 22.1    | 25.7    |

| Country              | ISO | Average | Stand. Dev. | Median | Minimum | Maximum |
|----------------------|-----|---------|-------------|--------|---------|---------|
| Qatar                | QAT | 15.9    | 2.1         | 16.7   | 12.1    | 19      |
| Romania              | ROM | 30.1    | 4.2         | 31.1   | 22.4    | 36      |
| Russian Federation   | RUS | 42.6    | 5.6         | 41.9   | 35.2    | 52.9    |
| Rwanda               | RWA | 36.3    | 5           | 38.7   | 26.7    | 41.7    |
| Saudi Arabia         | SAU | 16.7    | 2           | 17.9   | 13.3    | 19.2    |
| Senegal              | SEN | 43.3    | 6.4         | 41.5   | 33.7    | 53.4    |
| Sierra Leone         | SLE | 41.5    | 6.4         | 43.2   | 25.7    | 50.1    |
| Singapore            | SGP | 11.9    | 1.3         | 12.2   | 9.9     | 13.8    |
| Slovak Republic      | SVK | 16.6    | 2.8         | 17.9   | 12.5    | 20.8    |
| Slovenia             | SVN | 26      | 3.2         | 26.3   | 19.5    | 31.4    |
| Solomon Islands      | SLB | 30.4    | 4.1         | 30.2   | 24.9    | 37.4    |
| South Africa         | ZAF | 25.9    | 3.6         | 27.6   | 20.3    | 31.2    |
| Spain                | ESP | 25.2    | 1.9         | 25.6   | 22.7    | 28.7    |
| Sri Lanka            | LKA | 45.5    | 4.7         | 46.3   | 35.5    | 52.9    |
| Suriname             | SUR | 32.2    | 6.4         | 35.3   | 22.5    | 39.8    |
| Swaziland            | SWZ | 40      | 2.7         | 39.6   | 34.7    | 44.1    |
| Sweden               | SWE | 19.9    | 2.2         | 19.2   | 16.7    | 24.5    |
| Switzerland          | CHE | 9       | 0.6         | 9.1    | 8       | 10      |
| Syrian Arab Republic | SYR | 19.6    | 2           | 19.2   | 15.7    | 24.2    |
| Taiwan               | TWN | 26.9    | 2.2         | 27.1   | 22.3    | 30.2    |
| Tajikistan           | TJK | 43      | 3.3         | 43.4   | 35.4    | 47.4    |
| Tanzania             | TZA | 52.2    | 6.3         | 54.3   | 38.9    | 60.3    |
| Thailand             | THA | 50.6    | 3.4         | 50.5   | 43.1    | 56.6    |
| Togo                 | TGO | 37.3    | 3.8         | 37.3   | 31.5    | 50.5    |
| Trinidad and Tobago  | TTO | 34.4    | 5.9         | 33.1   | 26.1    | 44.8    |
| Tunisia              | TUN | 35.3    | 4.4         | 36.3   | 27.2    | 42      |
| Turkey               | TUR | 31.3    | 2.7         | 32     | 27.3    | 36      |
| Uganda               | UGA | 38.7    | 4           | 40.7   | 31.9    | 43.2    |
| Ukraine              | UKR | 44.8    | 5.7         | 42.9   | 36.7    | 57      |
| United Arab Emirates | ARE | 28.7    | 1.6         | 28.1   | 26.4    | 32.1    |
| United Kingdom       | GBR | 13.3    | 1           | 13.1   | 11.7    | 15.8    |
| United States        | USA | 9.4     | 0.9         | 9.3    | 8.1     | 11.2    |
| Uruguay              | URY | 45.7    | 6.1         | 47.2   | 35.6    | 53.7    |
| Venezuela, RB        | VEN | 31.4    | 2.8         | 30.3   | 27.2    | 37.6    |
| Vietnam              | VNM | 15.1    | 2.3         | 15.3   | 11.2    | 18.6    |
| Yemen, Rep.          | YEM | 28.3    | 4           | 28.4   | 22.9    | 35      |
| Zambia               | ZMB | 45.3    | 7.5         | 48.5   | 30.7    | 54.2    |
| Zimbabwe             | ZWE | 60.6    | 4.3         | 60.6   | 52.1    | 69.1    |

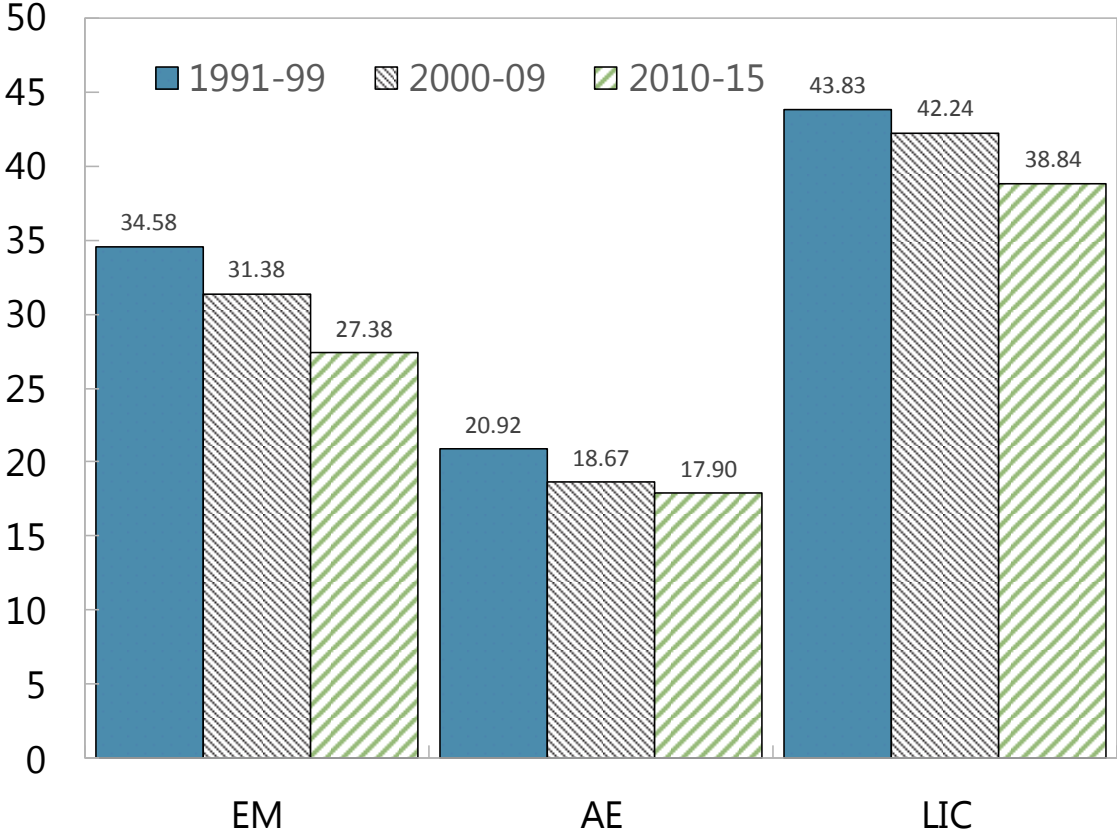
Source: Own calculations.

**Figure 5.1 Shadow Economy by Region (average, percent of GDP)**



Source: Own calculations.

**Figure 5.2 Shadow Economy by Income Level (average, percent of GDP)**

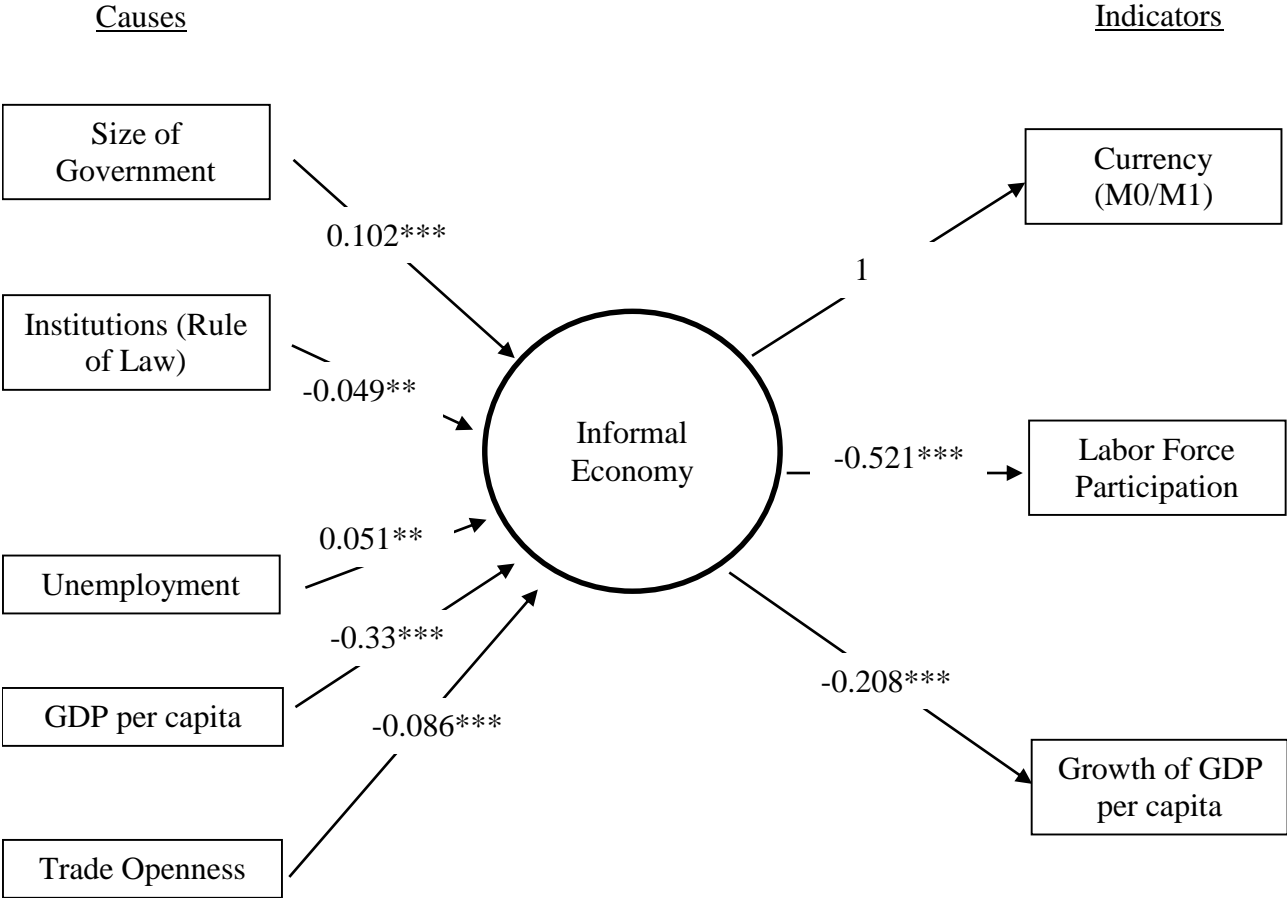


Source: Own calculations.



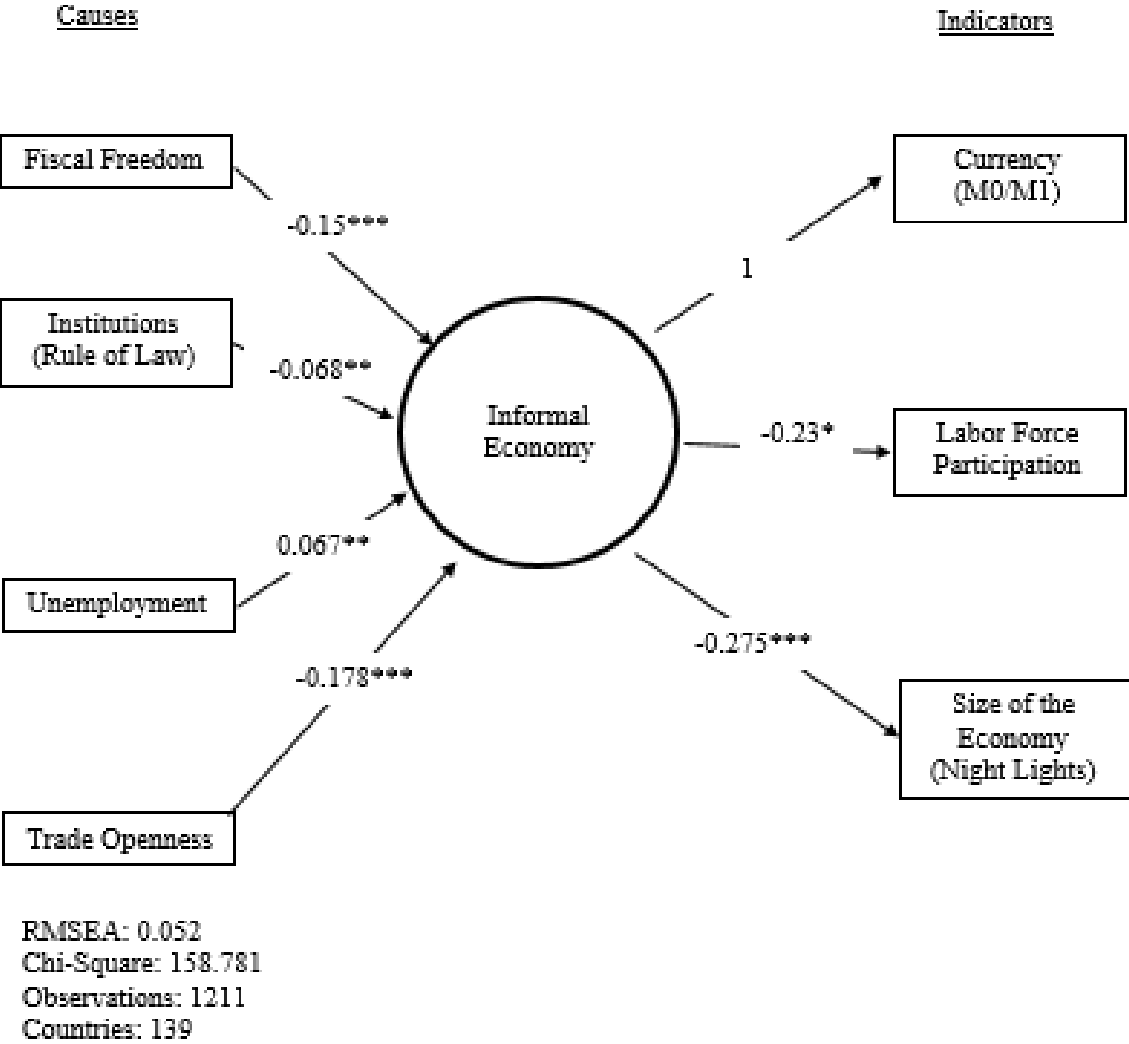
# Appendix

Figure A.1: Informal Economy Estimation: The MIMIC Model



RMSEA: 0.073  
 Chi-Square: 513.407  
 Observations: 1897  
 Countries: 151

Figure A.2: Informal Economy Estimation: The MIMIC Model using night lights



Source: Own calculations.

**Table A.1: Size and development of the shadow economy of 158 countries over the period 1999 to 2015 – Part I (1991-2003)**

| No. | Country      | 1991  | 1992  | 1993  | 1994  | 1995  | 1996  | 1997  | 1998  | 1999  | 2000  | 2001  | 2002  | 2003  |
|-----|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1   | Albania      | 43.18 | 40.18 | 39.45 | 40.07 | 39.18 | 37.07 | 37.59 | 38.16 | 36.04 | 35.30 | 36.04 | 33.67 | 32.64 |
| 2   | Algeria      | 34.96 | 36.14 | 38.16 | 38.88 | 37.64 | 37.68 | 37.18 | 38.28 | 36.11 | 34.20 | 33.58 | 31.90 | 29.62 |
| 3   | Angola       | 50.17 | 47.80 | 55.43 | 50.48 | 52.47 | 46.30 | 50.48 | 49.21 | 48.64 | 48.80 | 46.14 | 48.40 | 48.86 |
| 4   | Argentina    | 25.22 | 24.41 | 26.59 | 26.22 | 27.18 | 25.32 | 25.20 | 24.00 | 25.83 | 25.40 | 26.94 | 26.19 | 25.37 |
| 5   | Armenia      | 46.65 | 49.50 | 48.63 | 44.66 | 47.14 | 47.48 | 46.41 | 45.81 | 46.85 | 46.60 | 47.61 | 44.11 | 42.08 |
| 6   | Australia    | 16.89 | 17.83 | 17.35 | 16.38 | 15.62 | 15.75 | 14.92 | 14.49 | 14.60 | 14.30 | 13.70 | 13.63 | 13.28 |
| 7   | Austria      | 10.03 | 10.27 | 10.95 | 10.65 | 10.66 | 10.85 | 10.57 | 10.47 | 10.24 | 9.80  | 9.50  | 9.53  | 9.70  |
| 8   | Azerbaijan   | 54.69 | 53.67 | 60.46 | 64.66 | 59.95 | 59.22 | 58.85 | 61.13 | 59.52 | 60.60 | 58.29 | 55.95 | 54.18 |
| 9   | Bahamas, The | 35.61 | 38.96 | 38.60 | 39.31 | 36.81 | 35.56 | 34.08 | 31.13 | 28.28 | 26.20 | 26.86 | 26.43 | 28.76 |
| 10  | Bahrain      | 22.49 | 21.83 | 19.65 | 19.80 | 19.64 | 19.72 | 19.18 | 19.37 | 18.84 | 18.40 | 18.76 | 18.67 | 18.35 |
| 11  | Bangladesh   | 36.34 | 36.48 | 37.12 | 36.71 | 35.27 | 35.70 | 35.78 | 35.87 | 35.60 | 35.60 | 34.48 | 35.12 | 36.65 |
| 12  | Belarus      | 52.78 | 47.83 | 47.95 | 49.54 | 53.57 | 52.24 | 51.11 | 49.32 | 50.14 | 48.10 | 49.39 | 49.73 | 48.64 |
| 13  | Belgium      | 24.40 | 24.37 | 25.61 | 25.79 | 25.49 | 25.71 | 24.49 | 25.22 | 23.93 | 22.20 | 22.08 | 23.23 | 23.95 |
| 14  | Belize       | 50.98 | 51.65 | 51.78 | 52.39 | 53.69 | 53.09 | 52.69 | 52.60 | 49.01 | 43.80 | 44.59 | 45.03 | 42.98 |
| 15  | Benin        | 58.78 | 60.80 | 58.66 | 56.88 | 54.86 | 52.65 | 53.47 | 51.49 | 51.24 | 50.20 | 50.34 | 49.72 | 53.24 |
| 16  | Bhutan       | 31.24 | 30.66 | 30.20 | 29.64 | 27.82 | 31.00 | 29.94 | 28.75 | 27.98 | 29.40 | 29.21 | 29.28 | 28.18 |
| 17  | Bolivia      | 68.09 | 71.34 | 71.08 | 70.39 | 69.40 | 66.78 | 67.31 | 63.69 | 68.67 | 67.10 | 70.57 | 68.82 | 69.01 |

| No. | Country                  | 1991  | 1992  | 1993  | 1994  | 1995  | 1996  | 1997  | 1998  | 1999  | 2000  | 2001  | 2002  | 2003  |
|-----|--------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 18  | Bosnia and Herzegovina   | 31.38 | 32.18 | 33.43 | 43.30 | 44.45 | 38.53 | 36.66 | 33.25 | 32.87 | 34.10 | 33.99 | 37.34 | 35.94 |
| 19  | Botswana                 | 33.57 | 35.44 | 36.37 | 35.89 | 35.52 | 35.20 | 32.98 | 34.18 | 32.95 | 33.40 | 33.05 | 32.08 | 31.43 |
| 20  | Brazil                   | 40.64 | 39.67 | 39.25 | 38.25 | 39.61 | 40.83 | 40.50 | 41.69 | 40.79 | 39.80 | 38.65 | 38.50 | 38.89 |
| 21  | Brunei Darussalam        | 29.84 | 29.20 | 29.60 | 30.73 | 28.26 | 26.98 | 28.48 | 30.84 | 31.83 | 31.10 | 30.42 | 29.78 | 29.52 |
| 22  | Bulgaria                 | 36.73 | 36.59 | 37.65 | 36.17 | 34.53 | 33.05 | 32.32 | 34.43 | 36.20 | 36.90 | 36.51 | 35.05 | 34.57 |
| 23  | Burkina Faso             | 43.42 | 44.06 | 44.89 | 44.75 | 43.59 | 43.91 | 41.76 | 41.26 | 38.81 | 41.40 | 41.20 | 41.22 | 39.34 |
| 24  | Burundi                  | 26.87 | 28.78 | 31.52 | 32.17 | 34.62 | 39.84 | 38.61 | 37.99 | 38.88 | 39.50 | 39.36 | 39.05 | 40.02 |
| 25  | Cabo Verde               | 44.03 | 44.69 | 47.21 | 43.88 | 43.76 | 39.60 | 41.17 | 38.48 | 38.25 | 36.10 | 35.30 | 36.05 | 37.16 |
| 26  | Cambodia                 | 44.12 | 45.40 | 54.06 | 56.69 | 54.55 | 55.11 | 53.95 | 53.24 | 51.95 | 50.10 | 49.80 | 49.35 | 49.66 |
| 27  | Cameroon                 | 35.14 | 35.48 | 37.91 | 34.86 | 33.00 | 35.60 | 34.03 | 33.37 | 33.58 | 32.80 | 33.06 | 32.94 | 31.96 |
| 28  | Canada                   | 21.91 | 22.12 | 21.52 | 20.21 | 19.19 | 19.19 | 17.75 | 17.25 | 16.39 | 16.00 | 16.12 | 16.75 | 16.85 |
| 29  | Central African Republic | 39.80 | 43.28 | 43.64 | 41.94 | 39.84 | 42.26 | 39.11 | 38.70 | 41.43 | 42.60 | 41.84 | 40.28 | 43.12 |
| 30  | Chad                     | 45.92 | 45.75 | 48.86 | 46.23 | 46.18 | 46.31 | 46.04 | 44.36 | 46.60 | 46.20 | 45.23 | 40.32 | 42.04 |
| 31  | Chile                    | 20.73 | 20.52 | 20.72 | 20.41 | 19.51 | 19.96 | 18.93 | 19.67 | 20.64 | 19.80 | 19.43 | 19.24 | 18.70 |
| 32  | China                    | 14.07 | 13.63 | 13.46 | 13.03 | 12.46 | 12.67 | 12.67 | 12.73 | 13.12 | 13.10 | 12.93 | 12.42 | 11.72 |
| 33  | Colombia                 | 35.69 | 34.53 | 34.95 | 35.41 | 35.24 | 37.30 | 36.19 | 37.46 | 38.98 | 39.10 | 37.26 | 37.97 | 35.87 |

| No. | Country            | 1991  | 1992  | 1993  | 1994  | 1995  | 1996  | 1997  | 1998  | 1999  | 2000  | 2001  | 2002  | 2003  |
|-----|--------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 34  | Comoros            | 39.97 | 35.79 | 35.89 | 40.15 | 39.87 | 41.56 | 40.77 | 43.22 | 42.93 | 39.60 | 39.11 | 39.31 | 37.86 |
| 35  | Congo, Dem. Rep.   | 48.08 | 49.10 | 49.27 | 46.08 | 45.76 | 46.36 | 47.56 | 47.85 | 46.97 | 48.00 | 47.71 | 47.74 | 46.28 |
| 36  | Congo, Rep.        | 50.40 | 50.74 | 52.82 | 52.08 | 49.00 | 47.53 | 51.09 | 52.86 | 52.17 | 48.20 | 48.41 | 48.24 | 47.33 |
| 37  | Costa Rica         | 30.93 | 29.02 | 28.77 | 29.01 | 29.02 | 29.25 | 28.48 | 26.12 | 26.29 | 26.20 | 28.00 | 27.39 | 26.41 |
| 38  | Côte d'Ivoire      | 46.29 | 48.39 | 48.25 | 44.53 | 41.05 | 38.88 | 42.53 | 40.37 | 41.53 | 43.20 | 43.64 | 43.68 | 46.49 |
| 39  | Croatia            | 32.10 | 34.25 | 36.33 | 37.31 | 38.73 | 37.04 | 34.04 | 35.62 | 36.00 | 33.40 | 32.31 | 30.46 | 28.53 |
| 40  | Cyprus             | 36.22 | 34.72 | 35.29 | 34.09 | 27.91 | 28.94 | 28.96 | 30.51 | 30.13 | 28.70 | 28.40 | 29.31 | 31.62 |
| 41  | Czech Republic     | 20.72 | 20.07 | 20.48 | 20.52 | 19.11 | 18.35 | 19.00 | 18.61 | 19.45 | 19.10 | 18.10 | 19.05 | 19.38 |
| 42  | Denmark            | 20.48 | 20.43 | 21.46 | 20.09 | 19.55 | 19.90 | 18.57 | 18.94 | 18.56 | 18.00 | 17.63 | 18.17 | 18.34 |
| 43  | Dominican Republic | 35.84 | 35.85 | 35.62 | 34.73 | 34.41 | 33.57 | 34.07 | 32.24 | 32.49 | 32.10 | 33.59 | 33.68 | 31.94 |
| 44  | Ecuador            | 35.84 | 35.47 | 36.03 | 36.98 | 35.69 | 34.54 | 36.58 | 34.75 | 37.02 | 34.40 | 36.05 | 35.81 | 36.42 |
| 45  | Egypt, Arab. Rep.  | 36.02 | 35.57 | 36.51 | 36.82 | 36.85 | 35.28 | 35.99 | 35.47 | 35.83 | 35.10 | 35.49 | 35.70 | 35.16 |
| 46  | El Salvador        | 52.74 | 52.96 | 52.82 | 49.56 | 48.33 | 50.78 | 47.93 | 47.80 | 46.88 | 46.30 | 46.03 | 44.19 | 43.53 |
| 47  | Equatorial Guinea  | 37.64 | 37.54 | 38.10 | 37.27 | 35.97 | 32.71 | 33.10 | 33.47 | 32.69 | 32.80 | 30.75 | 32.06 | 30.82 |
| 48  | Eritrea            | 37.57 | 48.92 | 44.07 | 36.69 | 38.65 | 33.54 | 31.42 | 34.25 | 38.16 | 40.30 | 36.28 | 35.68 | 39.56 |

| No. | Country              | 1991  | 1992  | 1993  | 1994  | 1995  | 1996  | 1997  | 1998  | 1999  | 2000  | 2001  | 2002  | 2003  |
|-----|----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 49  | Estonia              | 28.54 | 31.04 | 34.13 | 34.79 | 35.51 | 35.22 | 32.01 | 31.79 | 32.59 | 32.70 | 31.16 | 30.39 | 29.77 |
| 50  | Ethiopia             | 38.29 | 37.77 | 36.71 | 37.55 | 38.05 | 36.39 | 36.22 | 37.83 | 39.82 | 40.30 | 37.98 | 38.79 | 39.30 |
| 51  | Fiji                 | 38.88 | 38.44 | 38.40 | 35.64 | 34.81 | 32.50 | 35.63 | 35.77 | 32.90 | 33.60 | 32.84 | 31.17 | 31.74 |
| 52  | Finland              | 22.12 | 22.71 | 22.60 | 21.92 | 21.34 | 21.51 | 20.11 | 19.37 | 18.99 | 18.10 | 18.06 | 18.60 | 18.31 |
| 53  | France               | 16.36 | 16.98 | 18.16 | 18.00 | 17.60 | 17.68 | 17.41 | 16.74 | 16.32 | 15.20 | 14.71 | 16.12 | 15.98 |
| 54  | Gabon                | 48.72 | 50.91 | 48.21 | 43.95 | 43.84 | 44.23 | 41.60 | 43.10 | 49.15 | 48.00 | 56.07 | 55.82 | 57.40 |
| 55  | Gambia, The          | 50.65 | 49.38 | 49.46 | 53.55 | 56.73 | 55.31 | 54.35 | 51.61 | 48.35 | 45.10 | 42.36 | 51.76 | 42.85 |
| 56  | Georgia              | 61.47 | 65.31 | 65.01 | 63.70 | 71.95 | 71.33 | 69.35 | 71.27 | 70.10 | 67.30 | 66.86 | 67.53 | 64.90 |
| 57  | Germany              | 16.36 | 16.88 | 17.38 | 17.28 | 17.16 | 17.72 | 17.07 | 16.82 | 16.42 | 16.00 | 15.58 | 16.11 | 16.28 |
| 58  | Ghana                | 46.07 | 46.12 | 47.71 | 46.18 | 44.98 | 46.97 | 44.65 | 45.70 | 44.58 | 41.90 | 42.62 | 42.66 | 42.60 |
| 59  | Greece               | 31.39 | 31.06 | 31.95 | 31.52 | 32.36 | 31.23 | 31.51 | 30.83 | 30.42 | 28.70 | 29.06 | 29.61 | 28.77 |
| 60  | Guatemala            | 63.95 | 63.38 | 61.90 | 60.18 | 59.76 | 60.86 | 58.75 | 57.45 | 54.66 | 51.50 | 54.44 | 55.29 | 56.06 |
| 61  | Guinea               | 41.22 | 41.34 | 41.16 | 41.88 | 41.75 | 42.03 | 41.32 | 39.73 | 40.14 | 39.70 | 39.12 | 38.09 | 39.01 |
| 62  | Guinea-Bissau        | 30.64 | 30.50 | 32.41 | 30.82 | 30.73 | 27.98 | 21.98 | 42.76 | 37.78 | 39.60 | 39.88 | 41.71 | 42.40 |
| 62  | Guyana               | 36.55 | 35.01 | 34.54 | 34.18 | 33.53 | 31.45 | 32.07 | 31.70 | 32.40 | 33.60 | 33.86 | 34.17 | 35.83 |
| 64  | Haiti                | 42.14 | 46.75 | 44.87 | 55.79 | 50.18 | 52.83 | 50.89 | 57.19 | 54.69 | 55.40 | 56.61 | 59.12 | 56.05 |
| 65  | Honduras             | 53.74 | 51.79 | 49.64 | 49.83 | 48.89 | 49.12 | 46.96 | 48.10 | 50.41 | 49.60 | 50.45 | 49.28 | 49.36 |
| 66  | Hong Kong SAR, China | 15.75 | 15.69 | 15.48 | 15.31 | 15.56 | 16.13 | 15.36 | 16.84 | 16.93 | 16.60 | 16.54 | 16.99 | 16.61 |

| No. | Country          | 1991  | 1992  | 1993  | 1994  | 1995  | 1996  | 1997  | 1998  | 1999  | 2000  | 2001  | 2002  | 2003  |
|-----|------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 67  | Hungary          | 31.89 | 32.26 | 33.69 | 32.03 | 30.18 | 29.18 | 28.35 | 27.11 | 26.57 | 25.10 | 24.70 | 24.14 | 24.19 |
| 68  | Iceland          | 16.63 | 17.41 | 17.61 | 17.32 | 17.33 | 17.14 | 16.52 | 16.24 | 16.01 | 15.90 | 15.65 | 16.24 | 16.17 |
| 69  | India            | 24.83 | 24.36 | 24.42 | 22.90 | 23.07 | 22.09 | 23.47 | 23.36 | 24.23 | 23.10 | 23.02 | 22.88 | 21.24 |
| 70  | Indonesia        | 22.69 | 21.88 | 22.08 | 21.29 | 20.32 | 19.34 | 19.19 | 17.48 | 20.03 | 19.40 | 19.75 | 21.13 | 21.60 |
| 71  | Iran, Islam Rep. | 19.13 | 19.54 | 20.42 | 20.85 | 21.06 | 20.65 | 20.07 | 20.35 | 19.88 | 18.90 | 19.89 | 18.39 | 17.02 |
| 72  | Ireland          | 20.86 | 20.80 | 20.61 | 20.17 | 19.25 | 19.19 | 18.01 | 17.26 | 16.32 | 15.90 | 15.42 | 15.73 | 16.26 |
| 73  | Israel           | 25.02 | 24.83 | 24.05 | 23.18 | 23.42 | 22.26 | 23.38 | 23.18 | 22.91 | 21.90 | 22.82 | 22.81 | 23.32 |
| 74  | Italy            | 33.54 | 32.92 | 32.71 | 31.55 | 29.20 | 28.58 | 29.53 | 28.54 | 28.94 | 27.10 | 27.95 | 27.86 | 28.68 |
| 75  | Jamaica          | 36.02 | 32.72 | 32.76 | 31.25 | 31.18 | 33.89 | 36.11 | 34.82 | 35.76 | 36.40 | 35.23 | 35.76 | 34.57 |
| 76  | Japan            | 10.35 | 10.46 | 10.67 | 10.80 | 10.85 | 10.72 | 10.61 | 10.91 | 11.22 | 11.20 | 11.31 | 11.79 | 11.57 |
| 77  | Jordan           | 21.12 | 19.75 | 20.27 | 20.58 | 19.81 | 19.91 | 19.92 | 19.93 | 19.76 | 19.40 | 19.29 | 19.34 | 18.26 |
| 78  | Kazakhstan       | 43.62 | 43.41 | 44.49 | 42.63 | 46.08 | 47.35 | 45.99 | 45.66 | 44.61 | 43.20 | 42.73 | 40.89 | 39.58 |
| 79  | Kenya            | 34.75 | 35.01 | 31.63 | 32.21 | 31.68 | 34.08 | 34.68 | 36.24 | 35.46 | 34.30 | 34.45 | 35.34 | 35.92 |
| 80  | Korea, Rep.      | 29.13 | 29.23 | 29.14 | 28.35 | 27.48 | 28.03 | 26.97 | 30.04 | 28.49 | 27.50 | 27.37 | 26.76 | 27.41 |
| 81  | Kuwait           | 18.55 | 21.40 | 20.35 | 19.83 | 19.39 | 19.03 | 19.18 | 19.22 | 20.66 | 20.10 | 20.67 | 20.91 | 18.79 |
| 82  | Kyrgyz Republic  | 35.75 | 38.76 | 41.83 | 44.44 | 45.93 | 43.02 | 41.83 | 41.65 | 41.94 | 41.20 | 40.35 | 43.00 | 39.05 |
| 83  | Laos             | 36.16 | 35.88 | 35.62 | 35.02 | 35.00 | 33.96 | 33.70 | 32.10 | 32.04 | 30.60 | 30.66 | 30.80 | 31.33 |

| No. | Country    | 1991  | 1992  | 1993  | 1994  | 1995  | 1996  | 1997  | 1998  | 1999  | 2000  | 2001  | 2002  | 2003  |
|-----|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 84  | Latvia     | 23.87 | 28.24 | 29.09 | 28.59 | 32.45 | 31.87 | 30.76 | 31.24 | 30.87 | 30.50 | 28.98 | 28.92 | 27.51 |
| 85  | Lebanon    | 36.68 | 35.85 | 34.93 | 33.96 | 33.03 | 32.23 | 33.07 | 33.27 | 34.54 | 34.10 | 34.47 | 34.23 | 34.79 |
| 86  | Lesotho    | 35.12 | 35.37 | 35.76 | 34.37 | 35.17 | 32.57 | 34.58 | 32.02 | 32.97 | 31.30 | 31.51 | 29.85 | 30.58 |
| 87  | Liberia    | 42.08 | 43.89 | 44.70 | 45.25 | 45.55 | 46.67 | 45.12 | 45.95 | 44.64 | 43.20 | 42.23 | 41.84 | 43.02 |
| 88  | Libya      | 34.24 | 36.22 | 35.75 | 35.07 | 34.68 | 36.26 | 36.26 | 38.21 | 36.20 | 35.10 | 36.24 | 34.94 | 31.83 |
| 89  | Lithuania  | 23.75 | 26.38 | 28.96 | 31.36 | 35.09 | 34.82 | 33.50 | 33.87 | 33.48 | 33.70 | 31.91 | 31.05 | 29.61 |
| 90  | Luxembourg | 11.07 | 11.43 | 11.37 | 11.24 | 11.40 | 11.97 | 11.38 | 10.90 | 10.37 | 9.80  | 10.18 | 10.32 | 10.71 |
| 91  | Madagascar | 40.40 | 41.06 | 41.06 | 41.22 | 40.90 | 44.34 | 41.95 | 41.67 | 40.21 | 39.60 | 41.16 | 47.41 | 45.47 |
| 92  | Malawi     | 39.40 | 40.32 | 40.19 | 43.66 | 39.25 | 39.91 | 40.17 | 38.55 | 37.52 | 40.30 | 40.34 | 41.99 | 39.41 |
| 93  | Malaysia   | 37.47 | 37.30 | 36.79 | 35.04 | 33.22 | 30.58 | 30.37 | 32.10 | 31.63 | 31.10 | 32.27 | 32.65 | 32.03 |
| 94  | Maldives   | 28.11 | 28.29 | 27.35 | 26.75 | 31.50 | 30.21 | 30.98 | 30.22 | 30.60 | 30.30 | 29.39 | 28.93 | 27.73 |
| 95  | Mali       | 44.15 | 45.15 | 45.28 | 42.78 | 43.40 | 43.36 | 41.10 | 44.71 | 42.22 | 42.30 | 39.63 | 39.70 | 38.10 |
| 96  | Malta      | 31.54 | 30.61 | 31.40 | 31.03 | 30.88 | 33.12 | 31.65 | 30.61 | 29.72 | 27.10 | 30.66 | 30.15 | 30.99 |
| 97  | Mauritania | 36.00 | 36.59 | 35.26 | 36.38 | 33.39 | 31.80 | 35.57 | 36.45 | 36.09 | 36.10 | 37.39 | 38.57 | 38.27 |
| 98  | Mauritius  | 25.83 | 25.61 | 25.94 | 26.19 | 25.86 | 25.43 | 24.12 | 22.90 | 24.01 | 23.10 | 21.67 | 22.14 | 22.66 |
| 99  | Mexico     | 33.06 | 33.53 | 36.34 | 35.81 | 38.25 | 36.63 | 33.70 | 32.62 | 31.44 | 30.10 | 31.20 | 30.99 | 30.84 |
| 100 | Moldova    | 38.89 | 43.96 | 44.53 | 48.96 | 49.08 | 47.10 | 44.20 | 42.98 | 46.30 | 45.10 | 45.23 | 46.53 | 45.50 |
| 101 | Mongolia   | 18.83 | 20.65 | 19.53 | 21.12 | 20.12 | 19.54 | 19.15 | 18.81 | 18.87 | 18.40 | 18.88 | 18.01 | 17.68 |



| No. | Country             | 1991  | 1992  | 1993  | 1994  | 1995  | 1996  | 1997  | 1998  | 1999  | 2000  | 2001  | 2002  | 2003  |
|-----|---------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 102 | Morocco             | 36.59 | 38.18 | 40.33 | 38.96 | 40.42 | 35.91 | 38.68 | 35.70 | 37.28 | 36.40 | 36.48 | 35.25 | 34.72 |
| 103 | Mozambique          | 43.14 | 44.97 | 44.79 | 46.87 | 42.39 | 41.06 | 40.67 | 41.11 | 40.14 | 40.30 | 39.03 | 36.57 | 36.60 |
| 104 | Myanmar             | 63.83 | 61.85 | 61.55 | 60.53 | 59.12 | 58.63 | 57.67 | 57.77 | 53.59 | 52.60 | 49.77 | 47.66 | 43.64 |
| 105 | Namibia             | 31.84 | 31.86 | 32.12 | 31.96 | 32.09 | 31.57 | 31.89 | 31.45 | 31.88 | 31.40 | 31.32 | 29.14 | 28.82 |
| 106 | Nepal               | 43.39 | 40.59 | 40.88 | 39.15 | 39.97 | 40.59 | 39.59 | 38.68 | 38.04 | 36.80 | 37.20 | 37.71 | 37.35 |
| 107 | Netherlands,<br>The | 15.81 | 15.73 | 15.98 | 15.86 | 15.60 | 15.40 | 14.39 | 14.11 | 13.52 | 13.10 | 13.00 | 13.93 | 14.35 |
| 108 | New Zealand         | 16.07 | 15.72 | 14.95 | 14.02 | 13.80 | 13.85 | 13.88 | 14.03 | 13.23 | 12.60 | 11.95 | 12.46 | 12.46 |
| 109 | Nicaragua           | 44.54 | 44.75 | 44.82 | 44.71 | 44.74 | 42.70 | 42.99 | 43.01 | 43.23 | 45.20 | 43.76 | 43.50 | 43.68 |
| 110 | Niger               | 38.66 | 43.09 | 42.70 | 41.65 | 40.80 | 40.23 | 41.28 | 39.04 | 42.00 | 41.90 | 40.06 | 40.25 | 41.63 |
| 111 | Nigeria             | 56.95 | 58.17 | 58.82 | 66.61 | 62.21 | 61.09 | 60.69 | 62.33 | 59.87 | 57.90 | 57.64 | 59.93 | 57.19 |
| 112 | Norway              | 22.65 | 23.70 | 23.57 | 22.75 | 22.17 | 21.24 | 19.84 | 20.17 | 20.44 | 19.10 | 19.13 | 21.60 | 21.82 |
| 113 | Oman                | 23.41 | 22.56 | 22.42 | 22.42 | 21.99 | 20.72 | 20.11 | 19.88 | 20.04 | 18.90 | 18.82 | 19.82 | 20.17 |
| 114 | Pakistan            | 37.55 | 34.92 | 34.40 | 34.90 | 34.48 | 32.81 | 34.58 | 34.63 | 35.35 | 36.80 | 35.12 | 34.97 | 33.58 |
| 115 | Papua New<br>Guinea | 41.96 | 38.86 | 34.34 | 32.09 | 33.64 | 30.63 | 35.36 | 34.44 | 34.63 | 36.10 | 36.43 | 37.08 | 37.34 |
| 116 | Paraguay            | 34.63 | 35.39 | 33.95 | 32.29 | 30.67 | 32.67 | 34.54 | 34.87 | 37.79 | 39.80 | 39.65 | 40.32 | 37.60 |
| 117 | Peru                | 59.87 | 59.25 | 61.00 | 58.50 | 58.52 | 59.63 | 57.08 | 58.23 | 59.94 | 59.90 | 58.47 | 56.43 | 56.65 |
| 118 | Philippines         | 45.43 | 45.39 | 45.53 | 45.40 | 45.04 | 42.21 | 43.50 | 43.79 | 44.43 | 43.30 | 43.02 | 42.16 | 41.39 |

| No. | Country            | 1991  | 1992  | 1993  | 1994  | 1995  | 1996  | 1997  | 1998  | 1999  | 2000  | 2001  | 2002  | 2003  |
|-----|--------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 119 | Poland             | 34.50 | 34.10 | 33.36 | 31.61 | 30.94 | 29.80 | 29.00 | 27.54 | 28.10 | 27.60 | 28.30 | 28.09 | 27.82 |
| 120 | Portugal           | 24.58 | 24.96 | 25.70 | 25.48 | 24.92 | 24.31 | 24.11 | 23.18 | 23.32 | 22.70 | 23.09 | 23.00 | 23.66 |
| 121 | Qatar              | 16.41 | 15.40 | 15.80 | 17.65 | 16.68 | 18.21 | 17.02 | 16.65 | 17.21 | 19.00 | 18.32 | 17.74 | 18.31 |
| 122 | Romania            | 36.03 | 35.13 | 34.80 | 34.99 | 33.40 | 31.12 | 31.65 | 32.18 | 34.45 | 34.40 | 32.33 | 32.51 | 33.03 |
| 123 | Russian Federation | 43.92 | 35.68 | 45.72 | 49.23 | 49.84 | 51.02 | 52.92 | 51.91 | 46.24 | 46.10 | 45.00 | 44.97 | 44.27 |
| 124 | Rwanda             | 39.72 | 39.59 | 39.61 | 39.91 | 41.09 | 41.65 | 38.69 | 40.25 | 41.23 | 40.30 | 41.14 | 39.01 | 38.52 |
| 125 | Saudi Arabia       | 18.90 | 17.93 | 18.07 | 17.86 | 18.03 | 17.98 | 18.62 | 19.15 | 18.22 | 18.40 | 18.33 | 18.79 | 17.96 |
| 126 | Senegal            | 52.64 | 52.30 | 53.39 | 51.60 | 50.08 | 52.60 | 51.87 | 47.48 | 45.97 | 45.10 | 44.05 | 41.48 | 41.95 |
| 127 | Sierra Leone       | 38.20 | 41.77 | 43.17 | 43.67 | 44.51 | 46.36 | 46.60 | 45.96 | 48.49 | 48.60 | 50.14 | 47.76 | 45.34 |
| 128 | Singapore          | 13.69 | 13.38 | 13.13 | 12.56 | 12.17 | 12.76 | 12.26 | 13.56 | 12.86 | 13.10 | 13.40 | 13.76 | 13.00 |
| 129 | Slovak Republic    | 18.49 | 20.75 | 20.57 | 19.58 | 19.22 | 19.75 | 18.47 | 19.15 | 18.71 | 18.90 | 18.53 | 18.45 | 17.87 |
| 130 | Slovenia           | 29.31 | 30.49 | 31.37 | 30.06 | 30.07 | 28.92 | 28.44 | 26.91 | 27.78 | 27.10 | 26.90 | 26.40 | 26.30 |
| 131 | Solomon Islands    | 30.60 | 29.61 | 29.41 | 25.84 | 25.71 | 24.90 | 25.79 | 24.97 | 27.51 | 33.40 | 36.36 | 37.42 | 36.16 |
| 132 | South Africa       | 29.87 | 31.12 | 31.25 | 29.84 | 27.66 | 29.05 | 28.68 | 28.62 | 29.19 | 28.40 | 27.78 | 27.64 | 28.15 |
| 133 | Spain              | 27.49 | 28.04 | 28.69 | 27.98 | 27.37 | 26.13 | 25.96 | 24.78 | 24.47 | 22.70 | 23.02 | 23.13 | 23.05 |
| 134 | Sri Lanka          | 52.94 | 51.87 | 50.43 | 49.94 | 50.22 | 48.67 | 48.28 | 47.07 | 46.30 | 44.60 | 46.29 | 46.85 | 46.19 |

| No. | Country              | 1991  | 1992  | 1993  | 1994  | 1995  | 1996  | 1997  | 1998  | 1999  | 2000  | 2001  | 2002  | 2003  |
|-----|----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 135 | Suriname             | 36.49 | 38.08 | 39.36 | 38.26 | 37.60 | 39.11 | 37.28 | 37.94 | 38.13 | 39.80 | 36.42 | 36.36 | 35.31 |
| 136 | Swaziland            | 43.99 | 42.74 | 44.13 | 43.61 | 41.48 | 41.42 | 43.70 | 42.81 | 42.55 | 41.40 | 39.55 | 38.44 | 37.55 |
| 137 | Sweden               | 22.14 | 23.61 | 24.45 | 23.26 | 22.00 | 23.00 | 21.67 | 21.47 | 20.34 | 19.20 | 18.70 | 19.53 | 19.51 |
| 138 | Switzerland          | 9.36  | 9.88  | 10.03 | 10.03 | 9.88  | 9.85  | 9.63  | 9.13  | 9.07  | 8.60  | 8.87  | 9.14  | 9.58  |
| 139 | Syrian Arab. Rep.    | 24.23 | 21.90 | 20.58 | 19.13 | 18.80 | 18.35 | 18.72 | 17.27 | 18.88 | 19.30 | 19.47 | 18.83 | 19.16 |
| 140 | Taiwan               | 30.22 | 29.45 | 28.51 | 27.44 | 27.03 | 27.68 | 26.76 | 27.10 | 25.41 | 25.40 | 26.11 | 25.96 | 25.28 |
| 141 | Tajikistan           | 35.42 | 47.43 | 46.64 | 46.53 | 45.92 | 47.23 | 45.21 | 46.97 | 45.51 | 43.20 | 44.02 | 43.98 | 42.62 |
| 142 | Tanzania             | 60.32 | 59.95 | 58.11 | 57.47 | 54.69 | 55.35 | 56.10 | 57.87 | 58.43 | 58.30 | 57.09 | 55.25 | 53.90 |
| 143 | Thailand             | 55.72 | 54.05 | 54.34 | 53.11 | 51.84 | 50.05 | 51.98 | 55.43 | 56.64 | 52.60 | 54.17 | 51.36 | 50.51 |
| 144 | Togo                 | 38.45 | 40.70 | 50.52 | 42.68 | 40.48 | 36.69 | 32.17 | 34.52 | 35.24 | 35.10 | 37.73 | 37.75 | 36.86 |
| 145 | Trinidad and Tobago  | 43.72 | 44.75 | 44.26 | 43.02 | 41.56 | 40.18 | 38.91 | 37.03 | 37.98 | 34.40 | 35.73 | 34.27 | 33.09 |
| 146 | Tunisia              | 42.00 | 40.08 | 39.60 | 39.42 | 38.85 | 38.92 | 39.42 | 40.20 | 38.46 | 38.40 | 36.35 | 37.74 | 37.24 |
| 147 | Turkey               | 35.99 | 35.89 | 35.30 | 34.51 | 32.84 | 32.95 | 31.01 | 32.03 | 33.26 | 32.10 | 32.75 | 33.74 | 32.07 |
| 148 | Uganda               | 41.79 | 41.88 | 42.66 | 43.25 | 41.36 | 40.93 | 41.69 | 42.35 | 40.72 | 43.10 | 41.56 | 43.23 | 41.67 |
| 149 | Ukraine              | 38.96 | 41.79 | 44.06 | 48.12 | 48.92 | 51.76 | 56.31 | 57.00 | 51.91 | 52.20 | 49.06 | 47.06 | 45.29 |
| 150 | United Arab Emirates | 27.74 | 28.05 | 28.50 | 27.47 | 27.00 | 26.76 | 26.98 | 27.72 | 28.54 | 26.40 | 28.15 | 27.81 | 27.46 |

| No. | Country            | 1991  | 1992  | 1993  | 1994  | 1995  | 1996  | 1997  | 1998  | 1999  | 2000  | 2001  | 2002  | 2003  |
|-----|--------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 151 | United Kingdom     | 15.55 | 15.83 | 15.27 | 14.70 | 14.03 | 13.85 | 13.19 | 12.88 | 13.01 | 12.70 | 12.56 | 13.09 | 13.13 |
| 152 | United States      | 11.22 | 11.10 | 10.79 | 10.33 | 10.01 | 10.00 | 9.33  | 9.10  | 8.92  | 8.70  | 9.11  | 9.64  | 9.50  |
| 153 | Uruguay            | 52.99 | 51.04 | 51.91 | 49.92 | 52.52 | 53.69 | 47.96 | 47.20 | 50.21 | 51.10 | 51.57 | 51.33 | 48.18 |
| 154 | Venezuela, RB      | 29.62 | 28.72 | 28.72 | 29.29 | 29.81 | 27.24 | 32.68 | 33.17 | 35.78 | 33.60 | 35.86 | 36.30 | 37.63 |
| 155 | Vietnam            | 18.64 | 17.79 | 18.57 | 18.15 | 17.63 | 16.99 | 17.71 | 16.58 | 16.38 | 15.60 | 16.13 | 15.62 | 15.32 |
| 156 | Yemen, Rep.        | 35.03 | 34.24 | 34.02 | 34.35 | 30.83 | 29.39 | 29.80 | 30.17 | 28.35 | 27.40 | 26.48 | 27.20 | 25.42 |
| 157 | Zambia             | 54.17 | 50.68 | 50.91 | 51.39 | 51.33 | 52.41 | 51.74 | 51.61 | 49.86 | 48.90 | 48.85 | 47.71 | 48.40 |
| 158 | Zimbabwe           | 57.35 | 62.24 | 59.35 | 56.29 | 57.27 | 54.05 | 56.16 | 52.09 | 56.43 | 59.40 | 56.12 | 58.32 | 61.83 |
|     | Av. over countries | 34.91 | 35.22 | 35.62 | 35.29 | 34.89 | 34.53 | 34.20 | 34.23 | 34.18 | 33.66 | 33.56 | 33.54 | 33.13 |

Source: Own calculations.

**Table A.1: Size and development of the shadow economy of 158 countries over the period 1999 to 2015 – Part II (2004-2015)**

| No. | Country   | 2004  | 2005  | 2006  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | Av. over years |
|-----|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------------|
| 1   | Albania   | 31.72 | 30.89 | 29.58 | 28.53 | 27.12 | 26.91 | 26.10 | 25.41 | 25.52 | 25.68 | 25.78 | 26.21 | 32.72          |
| 2   | Algeria   | 27.76 | 24.93 | 24.44 | 24.21 | 24.07 | 25.90 | 25.89 | 27.37 | 26.94 | 25.98 | 25.74 | 23.98 | 30.86          |
| 3   | Angola    | 46.81 | 43.84 | 41.23 | 37.13 | 35.26 | 36.25 | 36.54 | 36.49 | 36.60 | 35.92 | 34.53 | 35.25 | 43.96          |
| 4   | Argentina | 24.32 | 23.21 | 22.63 | 21.93 | 21.87 | 22.97 | 21.64 | 20.80 | 21.62 | 21.57 | 22.02 | 24.99 | 24.14          |
| 5   | Armenia   | 43.57 | 41.03 | 41.38 | 39.47 | 35.39 | 41.04 | 40.14 | 38.46 | 35.52 | 34.56 | 34.78 | 35.96 | 42.59          |

| No. | Country                  | 2004  | 2005  | 2006  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | Av. over years |
|-----|--------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------------|
| 6   | Australia                | 13.31 | 13.45 | 12.86 | 12.52 | 12.16 | 12.59 | 13.34 | 13.07 | 13.03 | 13.15 | 12.09 | 13.00 | 14.13          |
| 7   | Austria                  | 9.72  | 9.86  | 9.34  | 8.69  | 8.78  | 10.65 | 10.07 | 9.47  | 9.40  | 9.68  | 9.39  | 10.01 | 9.93           |
| 8   | Azerbaijan               | 52.45 | 50.01 | 48.02 | 45.32 | 43.70 | 44.82 | 44.20 | 43.71 | 43.30 | 42.26 | 42.15 | 43.66 | 52.19          |
| 9   | Bahamas, The             | 29.23 | 27.92 | 27.50 | 27.37 | 30.82 | 37.73 | 37.77 | 38.57 | 37.62 | 39.51 | 38.92 | 38.55 | 33.52          |
| 10  | Bahrain                  | 17.64 | 17.54 | 18.12 | 18.79 | 18.16 | 20.33 | 20.30 | 21.01 | 21.11 | 20.03 | 19.21 | 16.63 | 19.34          |
| 11  | Bangladesh               | 36.50 | 34.95 | 34.13 | 32.93 | 31.32 | 31.47 | 30.78 | 28.79 | 28.97 | 28.22 | 27.42 | 27.16 | 33.57          |
| 12  | Belarus                  | 46.72 | 46.77 | 44.64 | 42.10 | 38.69 | 39.70 | 38.17 | 33.03 | 32.29 | 34.07 | 34.12 | 32.37 | 44.52          |
| 13  | Belgium                  | 23.42 | 23.41 | 23.04 | 21.57 | 21.58 | 24.04 | 23.10 | 22.01 | 22.58 | 23.11 | 22.36 | 23.10 | 23.59          |
| 14  | Belize                   | 44.56 | 43.74 | 41.18 | 41.87 | 40.67 | 47.13 | 45.51 | 45.45 | 45.38 | 44.08 | 44.69 | 42.29 | 46.83          |
| 15  | Benin                    | 55.49 | 56.38 | 55.79 | 52.75 | 53.52 | 56.63 | 54.49 | 55.12 | 53.64 | 50.71 | 46.33 | 48.28 | 53.66          |
| 16  | Bhutan                   | 27.26 | 27.15 | 25.91 | 25.87 | 24.63 | 26.04 | 24.19 | 23.40 | 22.26 | 21.81 | 21.06 | 20.28 | 26.93          |
| 17  | Bolivia                  | 66.74 | 65.64 | 61.77 | 59.97 | 54.65 | 58.40 | 55.06 | 51.82 | 49.64 | 48.18 | 46.93 | 45.98 | 62.28          |
| 18  | Bosnia and Herzegovina   | 33.57 | 32.72 | 33.48 | 33.11 | 30.97 | 33.13 | 33.18 | 32.60 | 32.59 | 31.38 | 31.19 | 29.88 | 34.21          |
| 19  | Botswana                 | 30.57 | 30.12 | 27.85 | 26.52 | 27.06 | 28.46 | 26.44 | 25.03 | 24.44 | 22.85 | 22.10 | 23.99 | 30.30          |
| 20  | Brazil                   | 37.29 | 38.47 | 37.62 | 37.05 | 35.16 | 36.90 | 34.55 | 33.06 | 32.71 | 32.56 | 33.01 | 35.22 | 37.63          |
| 21  | Brunei Darussalam        | 29.96 | 30.39 | 29.94 | 30.55 | 29.04 | 29.80 | 28.88 | 28.34 | 28.16 | 30.00 | 31.81 | 30.44 | 29.76          |
| 22  | Bulgaria                 | 32.18 | 30.23 | 28.38 | 25.30 | 24.37 | 25.68 | 25.02 | 23.99 | 23.72 | 23.97 | 23.20 | 22.43 | 30.77          |
| 23  | Burkina Faso             | 38.69 | 37.25 | 36.21 | 38.30 | 36.40 | 35.64 | 33.29 | 32.06 | 31.12 | 31.12 | 30.53 | 29.63 | 38.39          |
| 24  | Burundi                  | 39.75 | 38.08 | 35.96 | 38.89 | 38.23 | 37.95 | 38.64 | 37.86 | 37.04 | 36.93 | 36.25 | 35.68 | 36.74          |
| 25  | Cabo Verde               | 36.02 | 34.86 | 30.32 | 29.94 | 29.16 | 31.48 | 30.83 | 29.59 | 29.52 | 29.20 | 29.26 | 30.23 | 35.84          |
| 26  | Cambodia                 | 46.74 | 43.69 | 40.92 | 41.76 | 41.02 | 42.88 | 42.31 | 40.30 | 38.08 | 36.56 | 34.92 | 33.85 | 46.04          |
| 27  | Cameroon                 | 32.06 | 31.37 | 30.44 | 30.43 | 30.26 | 32.51 | 31.93 | 31.20 | 30.52 | 29.63 | 28.14 | 28.93 | 32.45          |
| 28  | Canada                   | 16.37 | 16.17 | 15.52 | 15.47 | 15.62 | 17.86 | 17.31 | 17.06 | 16.88 | 16.81 | 15.65 | 16.52 | 17.54          |
| 29  | Central African Republic | 42.12 | 41.58 | 39.12 | 38.15 | 38.88 | 38.23 | 37.54 | 36.94 | 37.85 | 52.64 | 55.96 | 50.71 | 41.90          |

| No. | Country               | 2004  | 2005  | 2006  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | Av.<br>over<br>years |
|-----|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------------------|
| 30  | Chad                  | 35.03 | 34.26 | 35.01 | 36.35 | 37.11 | 37.11 | 34.11 | 35.14 | 33.90 | 34.30 | 31.20 | 28.76 | 40.09                |
| 31  | Chile                 | 17.76 | 17.06 | 16.57 | 16.00 | 15.99 | 18.37 | 16.96 | 15.86 | 15.54 | 15.69 | 15.62 | 16.46 | 18.24                |
| 32  | China                 | 10.91 | 10.74 | 10.44 | 9.42  | 9.39  | 9.43  | 8.73  | 8.63  | 9.01  | 8.85  | 8.34  | 8.71  | 11.23                |
| 33  | Colombia              | 35.30 | 33.98 | 31.79 | 30.89 | 29.82 | 31.24 | 30.71 | 27.60 | 27.34 | 26.77 | 25.99 | 25.25 | 33.31                |
| 34  | Comoros               | 38.78 | 37.92 | 37.45 | 38.08 | 39.21 | 40.02 | 39.05 | 38.63 | 38.61 | 36.63 | 36.44 | 40.92 | 39.11                |
| 35  | Congo, Dem.<br>Rep.   | 46.64 | 46.53 | 47.09 | 44.51 | 44.06 | 46.36 | 44.19 | 44.81 | 45.98 | 45.65 | 41.07 | 46.95 | 46.42                |
| 36  | Congo, Rep.           | 46.31 | 44.52 | 41.81 | 45.64 | 43.27 | 40.65 | 36.40 | 36.43 | 37.13 | 36.28 | 33.18 | 35.05 | 45.10                |
| 37  | Costa Rica            | 26.30 | 25.36 | 24.42 | 23.50 | 23.60 | 26.63 | 26.90 | 27.02 | 26.06 | 26.11 | 25.71 | 21.54 | 26.72                |
| 38  | Côte d'Ivoire         | 45.62 | 44.55 | 43.84 | 44.39 | 43.94 | 42.81 | 42.15 | 43.63 | 43.47 | 41.06 | 38.94 | 42.40 | 43.43                |
| 39  | Croatia               | 27.50 | 26.36 | 25.20 | 23.90 | 22.96 | 26.67 | 27.00 | 26.04 | 26.66 | 26.68 | 25.88 | 25.36 | 30.25                |
| 40  | Cyprus                | 30.74 | 30.77 | 29.90 | 29.03 | 28.77 | 31.64 | 31.39 | 32.71 | 33.32 | 34.66 | 32.69 | 32.20 | 31.30                |
| 41  | Czech Republic        | 18.05 | 16.76 | 15.44 | 13.83 | 13.48 | 15.82 | 15.27 | 13.98 | 13.80 | 14.09 | 13.06 | 12.77 | 17.13                |
| 42  | Denmark               | 17.95 | 17.15 | 16.06 | 15.91 | 16.41 | 19.73 | 19.57 | 18.66 | 18.88 | 18.64 | 17.53 | 18.10 | 18.59                |
| 43  | Dominican<br>Republic | 32.34 | 32.95 | 30.78 | 31.24 | 31.26 | 33.10 | 30.71 | 30.48 | 30.58 | 29.02 | 27.60 | 27.97 | 32.33                |
| 44  | Ecuador               | 33.84 | 32.67 | 32.14 | 31.40 | 31.04 | 34.32 | 32.07 | 29.71 | 29.19 | 28.45 | 28.50 | 30.18 | 33.56                |
| 45  | Egypt, Arab.<br>Rep.  | 33.92 | 33.47 | 33.07 | 30.81 | 28.88 | 30.30 | 30.50 | 32.91 | 33.64 | 34.37 | 34.96 | 33.32 | 34.24                |
| 46  | El Salvador           | 42.21 | 42.74 | 42.34 | 40.93 | 40.05 | 45.73 | 44.69 | 42.77 | 42.72 | 41.78 | 41.30 | 42.60 | 45.59                |
| 47  | Equatorial<br>Guinea  | 29.77 | 30.15 | 29.27 | 27.70 | 27.16 | 27.87 | 28.76 | 28.37 | 28.55 | 29.92 | 32.20 | 31.38 | 31.84                |
| 48  | Eritrea               | 39.42 | 39.86 | 41.13 | 41.61 | 46.36 | 44.45 | 44.88 | 41.38 | 37.33 | 38.18 | 36.09 | 36.53 | 39.29                |
| 49  | Estonia               | 28.15 | 26.26 | 24.00 | 22.84 | 24.42 | 29.60 | 27.99 | 24.67 | 23.34 | 22.97 | 22.52 | 23.49 | 28.80                |
| 50  | Ethiopia              | 36.97 | 36.13 | 33.87 | 32.41 | 31.68 | 31.41 | 30.10 | 27.65 | 26.84 | 26.21 | 24.47 | 25.10 | 34.31                |
| 51  | Fiji                  | 27.94 | 28.57 | 30.42 | 32.33 | 29.84 | 33.48 | 32.06 | 29.64 | 29.48 | 31.19 | 28.97 | 25.37 | 32.47                |
| 52  | Finland               | 17.89 | 17.57 | 16.86 | 16.58 | 16.55 | 18.71 | 18.14 | 17.79 | 18.19 | 18.68 | 17.72 | 18.90 | 19.09                |
| 53  | France                | 15.40 | 15.36 | 14.71 | 14.28 | 14.01 | 16.29 | 15.51 | 15.21 | 15.48 | 15.81 | 15.52 | 15.50 | 16.01                |

| No. | Country                 | 2004  | 2005  | 2006  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | Av.<br>over<br>years |
|-----|-------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------------------|
| 54  | Gabon                   | 58.13 | 55.41 | 59.63 | 58.68 | 60.07 | 63.47 | 58.02 | 54.75 | 53.50 | 52.52 | 53.48 | 52.01 | 52.43                |
| 55  | Gambia, The             | 38.90 | 45.77 | 48.19 | 47.90 | 45.28 | 39.78 | 35.17 | 48.57 | 42.64 | 40.95 | 43.81 | 43.64 | 46.88                |
| 56  | Georgia                 | 66.10 | 66.91 | 63.79 | 64.55 | 67.93 | 68.46 | 64.73 | 60.86 | 58.67 | 56.57 | 54.10 | 53.07 | 64.87                |
| 57  | Germany                 | 15.90 | 15.71 | 14.51 | 13.66 | 13.69 | 15.79 | 14.98 | 14.15 | 13.95 | 14.32 | 13.27 | 13.85 | 15.63                |
| 58  | Ghana                   | 42.90 | 43.16 | 41.68 | 41.51 | 41.41 | 40.61 | 40.03 | 40.64 | 40.99 | 39.25 | 38.50 | 39.37 | 42.91                |
| 59  | Greece                  | 27.89 | 28.59 | 27.50 | 26.83 | 26.80 | 30.92 | 30.75 | 31.68 | 32.99 | 32.38 | 31.71 | 31.45 | 30.32                |
| 60  | Guatemala               | 53.47 | 53.12 | 50.46 | 49.68 | 50.47 | 53.26 | 52.23 | 51.76 | 50.62 | 50.48 | 47.82 | 46.88 | 54.74                |
| 61  | Guinea                  | 38.77 | 37.54 | 37.41 | 38.30 | 38.94 | 42.16 | 43.89 | 39.60 | 37.51 | 38.32 | 38.18 | 41.58 | 39.95                |
| 62  | Guinea-Bissau           | 41.51 | 40.07 | 40.40 | 39.20 | 38.51 | 38.61 | 37.54 | 34.13 | 39.01 | 38.69 | 38.75 | 34.94 | 36.42                |
| 62  | Guyana                  | 34.65 | 36.27 | 31.85 | 29.65 | 31.58 | 30.65 | 28.73 | 27.52 | 26.35 | 26.16 | 26.03 | 26.09 | 31.78                |
| 64  | Haiti                   | 54.67 | 55.02 | 56.53 | 58.25 | 54.15 | 53.72 | 52.93 | 52.30 | 52.49 | 51.84 | 51.21 | 56.38 | 53.28                |
| 65  | Honduras                | 47.36 | 44.37 | 42.68 | 41.14 | 40.97 | 45.48 | 44.90 | 41.96 | 42.12 | 42.37 | 39.51 | 37.68 | 46.31                |
| 66  | Hong Kong<br>SAR, China | 15.52 | 14.45 | 13.74 | 13.11 | 13.01 | 13.81 | 12.79 | 12.22 | 12.29 | 12.15 | 11.89 | 12.39 | 14.69                |
| 67  | Hungary                 | 22.88 | 22.52 | 21.05 | 20.40 | 20.58 | 23.18 | 22.82 | 21.87 | 22.26 | 21.63 | 20.78 | 20.49 | 25.19                |
| 68  | Iceland                 | 15.38 | 14.86 | 14.74 | 14.29 | 14.16 | 15.72 | 15.76 | 15.34 | 14.98 | 14.91 | 14.67 | 14.05 | 15.80                |
| 69  | India                   | 20.27 | 19.84 | 18.46 | 17.43 | 18.08 | 18.67 | 17.05 | 16.11 | 15.39 | 14.51 | 14.73 | 14.29 | 20.31                |
| 70  | Indonesia               | 20.88 | 20.52 | 20.57 | 19.83 | 19.10 | 19.99 | 19.14 | 18.35 | 17.92 | 17.62 | 16.75 | 17.46 | 19.77                |
| 71  | Iran, Islam Rep.        | 16.01 | 16.63 | 16.34 | 14.52 | 14.60 | 15.73 | 15.60 | 14.93 | 15.79 | 16.17 | 16.14 | 18.38 | 17.88                |
| 72  | Ireland                 | 16.02 | 15.58 | 15.09 | 15.05 | 15.95 | 16.86 | 16.28 | 15.99 | 15.90 | 15.64 | 14.73 | 14.68 | 16.94                |
| 73  | Israel                  | 22.43 | 21.84 | 21.11 | 20.58 | 20.37 | 21.50 | 20.48 | 19.40 | 19.85 | 19.90 | 19.39 | 19.68 | 21.98                |
| 74  | Italy                   | 28.57 | 29.02 | 28.21 | 26.83 | 27.91 | 31.71 | 30.53 | 28.94 | 29.93 | 30.89 | 30.73 | 29.37 | 29.59                |
| 75  | Jamaica                 | 32.20 | 33.19 | 30.71 | 30.61 | 30.42 | 35.55 | 36.92 | 35.43 | 36.28 | 35.83 | 34.00 | 35.45 | 34.12                |
| 76  | Japan                   | 11.09 | 10.91 | 10.35 | 10.14 | 10.21 | 11.39 | 10.93 | 10.89 | 10.73 | 10.28 | 9.69  | 10.19 | 10.77                |
| 77  | Jordan                  | 16.09 | 14.91 | 14.71 | 13.66 | 13.44 | 14.91 | 14.96 | 15.38 | 15.00 | 14.64 | 14.20 | 15.16 | 17.38                |
| 78  | Kazakhstan              | 38.41 | 36.39 | 35.12 | 34.21 | 32.66 | 34.65 | 33.03 | 31.61 | 31.92 | 30.77 | 30.06 | 32.82 | 38.88                |

| No. | Country         | 2004  | 2005  | 2006  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | Av.<br>over<br>years |
|-----|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------------------|
| 79  | Kenya           | 34.64 | 33.32 | 32.27 | 32.35 | 32.93 | 33.62 | 31.54 | 29.92 | 30.11 | 29.99 | 28.68 | 33.43 | 33.14                |
| 80  | Korea, Rep.     | 26.23 | 26.03 | 26.37 | 24.89 | 24.86 | 25.13 | 23.97 | 22.81 | 22.96 | 23.27 | 23.36 | 23.83 | 26.38                |
| 81  | Kuwait          | 17.63 | 16.33 | 15.85 | 15.71 | 16.45 | 18.98 | 19.75 | 19.81 | 19.86 | 20.55 | 22.07 | 21.72 | 19.31                |
| 82  | Kyrgyz Republic | 37.73 | 38.04 | 37.52 | 34.72 | 33.34 | 34.10 | 34.32 | 33.06 | 34.26 | 31.35 | 29.95 | 30.78 | 37.92                |
| 83  | Laos            | 30.35 | 29.31 | 28.08 | 27.52 | 27.37 | 28.33 | 26.53 | 25.78 | 25.29 | 25.73 | 24.10 | 25.00 | 30.25                |
| 84  | Latvia          | 25.85 | 23.73 | 21.93 | 20.84 | 22.07 | 24.96 | 24.21 | 22.47 | 21.12 | 20.48 | 19.72 | 20.42 | 26.03                |
| 85  | Lebanon         | 31.71 | 32.10 | 33.05 | 31.39 | 28.09 | 26.02 | 24.63 | 25.51 | 25.67 | 27.96 | 29.06 | 29.16 | 31.58                |
| 86  | Lesotho         | 31.05 | 31.86 | 30.89 | 30.07 | 28.68 | 29.85 | 28.81 | 28.20 | 27.79 | 26.71 | 24.56 | 32.32 | 31.28                |
| 87  | Liberia         | 41.31 | 42.47 | 39.95 | 42.71 | 43.09 | 43.45 | 41.57 | 41.52 | 42.23 | 42.37 | 42.45 | 43.67 | 43.24                |
| 88  | Libya           | 31.29 | 29.51 | 28.30 | 27.02 | 25.86 | 27.88 | 27.05 | 38.76 | 32.79 | 34.75 | 37.91 | 38.27 | 33.62                |
| 89  | Lithuania       | 28.29 | 26.48 | 24.98 | 23.18 | 22.88 | 26.89 | 25.73 | 23.46 | 21.92 | 20.90 | 20.22 | 21.25 | 27.75                |
| 90  | Luxembourg      | 10.67 | 10.72 | 10.33 | 9.37  | 9.65  | 11.01 | 10.37 | 10.34 | 10.80 | 10.65 | 10.39 | 10.38 | 10.67                |
| 91  | Madagascar      | 39.87 | 40.98 | 41.34 | 42.68 | 38.70 | 43.33 | 44.98 | 45.02 | 44.30 | 46.27 | 44.84 | 45.29 | 42.56                |
| 92  | Malawi          | 38.76 | 38.76 | 39.40 | 37.34 | 36.75 | 38.01 | 36.39 | 37.29 | 36.05 | 35.09 | 34.28 | 33.56 | 38.51                |
| 93  | Malaysia        | 30.59 | 29.77 | 29.21 | 29.23 | 30.03 | 31.71 | 30.17 | 29.82 | 29.78 | 29.84 | 26.41 | 27.87 | 31.48                |
| 94  | Maldives        | 26.83 | 27.82 | 30.09 | 27.92 | 24.85 | 25.80 | 25.28 | 24.39 | 24.49 | 24.21 | 23.41 | 20.65 | 27.44                |
| 95  | Mali            | 41.00 | 39.04 | 36.21 | 36.86 | 35.08 | 36.67 | 33.28 | 34.22 | 31.49 | 31.40 | 30.88 | 29.45 | 38.70                |
| 96  | Malta           | 31.92 | 30.84 | 28.69 | 26.96 | 27.30 | 30.55 | 29.19 | 28.06 | 27.25 | 27.15 | 28.08 | 29.43 | 29.80                |
| 97  | Mauritania      | 36.50 | 33.26 | 27.78 | 27.81 | 28.67 | 29.90 | 28.39 | 27.03 | 25.42 | 24.45 | 24.38 | 25.75 | 32.29                |
| 98  | Mauritius       | 23.06 | 23.05 | 22.49 | 20.85 | 19.24 | 21.18 | 20.83 | 19.67 | 19.24 | 20.28 | 19.62 | 19.23 | 22.57                |
| 99  | Mexico          | 29.81 | 29.47 | 28.53 | 28.65 | 29.82 | 32.65 | 31.15 | 30.25 | 29.52 | 30.05 | 29.14 | 28.37 | 31.68                |
| 100 | Moldova         | 42.90 | 41.60 | 43.84 | 41.50 | 40.89 | 45.06 | 43.52 | 41.05 | 40.84 | 39.26 | 37.35 | 39.68 | 43.43                |
| 101 | Mongolia        | 17.31 | 17.22 | 16.77 | 16.89 | 15.90 | 16.37 | 16.35 | 13.69 | 13.69 | 13.04 | 12.02 | 13.20 | 17.28                |
| 102 | Morocco         | 33.92 | 34.30 | 32.27 | 30.94 | 28.68 | 30.93 | 29.37 | 28.98 | 29.83 | 29.79 | 29.18 | 27.13 | 34.01                |
| 103 | Mozambique      | 36.36 | 35.16 | 34.26 | 33.53 | 33.16 | 32.84 | 31.50 | 31.37 | 30.13 | 31.46 | 31.71 | 30.98 | 37.20                |



| No. | Country               | 2004  | 2005  | 2006  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | Av.<br>over<br>years |
|-----|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------------------|
| 104 | Myanmar               | 43.91 | 39.86 | 48.41 | 46.38 | 48.89 | 49.30 | 48.60 | 47.56 | 45.49 | 43.93 | 43.30 | 50.99 | 51.39                |
| 105 | Namibia               | 28.68 | 28.21 | 26.00 | 25.11 | 23.96 | 24.54 | 24.79 | 23.46 | 22.85 | 22.85 | 22.23 | 21.78 | 28.07                |
| 106 | Nepal                 | 36.86 | 37.60 | 36.24 | 36.59 | 37.09 | 38.02 | 36.48 | 35.70 | 35.98 | 33.46 | 33.42 | 30.22 | 37.50                |
| 107 | Netherlands,<br>The   | 13.96 | 13.72 | 13.54 | 13.15 | 13.18 | 14.50 | 14.20 | 13.69 | 13.71 | 14.04 | 13.35 | 13.43 | 14.21                |
| 108 | New Zealand           | 12.17 | 12.63 | 12.82 | 12.67 | 12.86 | 13.76 | 13.72 | 13.29 | 13.43 | 13.19 | 12.43 | 12.27 | 13.37                |
| 109 | Nicaragua             | 43.72 | 41.78 | 42.11 | 41.40 | 41.79 | 42.91 | 42.76 | 40.90 | 40.12 | 38.47 | 38.58 | 39.51 | 42.63                |
| 110 | Niger                 | 42.76 | 42.33 | 40.95 | 41.45 | 39.27 | 38.94 | 35.85 | 36.51 | 35.77 | 35.48 | 35.74 | 34.12 | 39.70                |
| 111 | Nigeria               | 56.72 | 55.84 | 51.95 | 52.96 | 53.06 | 53.98 | 52.80 | 51.51 | 51.56 | 51.70 | 50.64 | 44.49 | 56.27                |
| 112 | Norway                | 19.92 | 19.30 | 17.69 | 17.43 | 16.87 | 20.77 | 20.45 | 20.03 | 19.72 | 20.04 | 19.75 | 21.47 | 20.47                |
| 113 | Oman                  | 19.90 | 20.38 | 19.55 | 18.18 | 15.52 | 16.83 | 16.76 | 17.65 | 18.25 | 19.07 | 21.07 | 23.91 | 19.93                |
| 114 | Pakistan              | 33.87 | 31.19 | 30.94 | 30.84 | 30.49 | 31.28 | 30.28 | 30.91 | 31.12 | 30.62 | 30.29 | 31.62 | 33.10                |
| 115 | Papua New<br>Guinea   | 35.67 | 37.81 | 37.24 | 35.29 | 35.14 | 33.83 | 32.20 | 28.49 | 27.07 | 26.32 | 23.25 | 35.16 | 34.01                |
| 116 | Paraguay              | 36.34 | 35.42 | 35.19 | 33.96 | 32.34 | 36.18 | 31.72 | 30.65 | 33.87 | 30.78 | 29.42 | 31.66 | 34.47                |
| 117 | Peru                  | 53.50 | 54.68 | 51.36 | 48.83 | 46.08 | 47.70 | 43.04 | 40.42 | 39.73 | 39.53 | 40.18 | 41.53 | 52.40                |
| 118 | Philippines           | 39.87 | 36.50 | 36.18 | 35.37 | 35.08 | 37.02 | 34.63 | 33.90 | 33.61 | 31.71 | 29.30 | 28.04 | 39.27                |
| 119 | Poland                | 27.24 | 26.72 | 25.58 | 23.91 | 23.05 | 22.96 | 22.33 | 20.73 | 20.44 | 20.26 | 19.49 | 19.07 | 26.50                |
| 120 | Portugal              | 23.56 | 23.98 | 23.99 | 23.35 | 23.04 | 24.97 | 24.09 | 23.67 | 23.54 | 23.68 | 22.59 | 22.12 | 23.82                |
| 121 | Qatar                 | 16.67 | 17.25 | 15.33 | 15.36 | 15.39 | 16.69 | 14.56 | 12.72 | 12.28 | 12.15 | 12.31 | 13.08 | 15.93                |
| 122 | Romania               | 30.57 | 30.49 | 28.88 | 27.03 | 25.44 | 28.23 | 26.76 | 25.41 | 25.14 | 23.97 | 22.73 | 22.44 | 30.13                |
| 123 | Russian<br>Federation | 41.87 | 40.60 | 39.66 | 37.78 | 36.79 | 40.98 | 37.89 | 36.22 | 36.07 | 36.40 | 35.23 | 37.91 | 42.57                |
| 124 | Rwanda                | 36.16 | 39.23 | 37.79 | 35.44 | 32.73 | 32.48 | 31.50 | 29.53 | 28.47 | 27.56 | 26.68 | 28.05 | 36.25                |
| 125 | Saudi Arabia          | 17.38 | 16.63 | 16.27 | 15.03 | 13.76 | 15.07 | 14.37 | 13.97 | 13.34 | 13.60 | 13.88 | 14.70 | 16.65                |
| 126 | Senegal               | 40.00 | 37.74 | 39.84 | 37.16 | 36.06 | 39.37 | 38.36 | 40.20 | 37.59 | 37.21 | 35.91 | 33.68 | 43.35                |
| 127 | Sierra Leone          | 43.88 | 43.45 | 42.96 | 40.92 | 40.87 | 40.60 | 39.34 | 36.12 | 32.36 | 25.69 | 26.47 | 34.18 | 41.50                |

| No. | Country                 | 2004  | 2005  | 2006  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | Av.<br>over<br>years |
|-----|-------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------------------|
| 128 | Singapore               | 11.74 | 11.13 | 10.88 | 10.51 | 10.72 | 11.87 | 10.72 | 10.13 | 9.90  | 10.15 | 9.90  | 10.35 | 11.90                |
| 129 | Slovak Republic         | 16.67 | 15.80 | 14.82 | 13.45 | 12.82 | 14.77 | 14.14 | 13.26 | 13.11 | 13.05 | 12.94 | 12.48 | 16.63                |
| 130 | Slovenia                | 25.15 | 24.60 | 22.84 | 19.86 | 19.48 | 24.14 | 24.44 | 24.08 | 24.79 | 24.92 | 23.39 | 22.11 | 25.99                |
| 131 | Solomon Islands         | 36.03 | 36.04 | 35.32 | 32.52 | 30.25 | 32.56 | 30.15 | 27.38 | 27.08 | 26.88 | 27.44 | 30.89 | 30.41                |
| 132 | South Africa            | 26.58 | 25.44 | 21.33 | 20.81 | 20.35 | 23.41 | 23.23 | 22.08 | 22.20 | 21.47 | 21.33 | 21.99 | 25.90                |
| 133 | Spain                   | 23.47 | 23.32 | 22.96 | 22.67 | 23.53 | 26.24 | 25.91 | 25.65 | 26.08 | 26.35 | 26.04 | 24.51 | 25.18                |
| 134 | Sri Lanka               | 45.63 | 45.93 | 46.17 | 45.55 | 46.35 | 48.85 | 41.88 | 39.33 | 37.53 | 38.14 | 37.02 | 35.49 | 45.50                |
| 135 | Suriname                | 33.21 | 31.42 | 29.60 | 27.57 | 26.38 | 26.89 | 25.18 | 23.00 | 23.14 | 22.46 | 22.65 | 23.80 | 32.22                |
| 136 | Swaziland               | 39.19 | 38.69 | 38.02 | 38.27 | 38.48 | 38.17 | 38.97 | 40.28 | 36.44 | 35.57 | 34.73 | 40.94 | 40.04                |
| 137 | Sweden                  | 18.66 | 18.92 | 17.74 | 16.72 | 16.90 | 19.31 | 18.05 | 17.68 | 18.49 | 18.91 | 18.48 | 18.34 | 19.88                |
| 138 | Switzerland             | 9.34  | 9.10  | 8.76  | 8.14  | 7.96  | 8.86  | 8.56  | 8.42  | 8.46  | 8.36  | 8.19  | 8.74  | 9.04                 |
| 139 | Syrian Arab.<br>Rep.    | 17.98 | 17.15 | 16.53 | 15.65 | 20.81 | 19.21 | 19.39 | 21.50 | 22.18 | 22.79 | 22.24 | 19.53 | 19.58                |
| 140 | Taiwan                  | 23.83 | 23.22 | 23.24 | 22.32 | 30.12 | 28.89 | 28.22 | 28.00 | 28.02 | 28.01 | 26.88 | 28.97 | 26.88                |
| 141 | Tajikistan              | 43.52 | 44.48 | 43.37 | 42.19 | 41.20 | 42.80 | 42.13 | 41.59 | 38.80 | 39.63 | 36.54 | 37.73 | 42.99                |
| 142 | Tanzania                | 53.00 | 51.40 | 54.32 | 48.78 | 47.18 | 49.49 | 46.73 | 44.08 | 44.29 | 44.04 | 40.45 | 38.91 | 52.22                |
| 143 | Thailand                | 49.45 | 48.70 | 48.24 | 48.11 | 47.84 | 51.22 | 48.65 | 47.88 | 46.67 | 46.74 | 47.25 | 43.12 | 50.63                |
| 144 | Togo                    | 38.24 | 38.93 | 38.14 | 37.27 | 38.40 | 37.53 | 35.90 | 35.12 | 35.09 | 34.16 | 33.52 | 31.49 | 37.31                |
| 145 | Trinidad and<br>Tobago  | 31.56 | 30.23 | 27.41 | 27.43 | 26.15 | 30.04 | 29.85 | 28.11 | 28.92 | 29.36 | 29.90 | 31.40 | 34.37                |
| 146 | Tunisia                 | 34.43 | 33.98 | 31.49 | 29.27 | 27.16 | 29.12 | 27.83 | 33.85 | 31.97 | 32.94 | 33.08 | 30.90 | 35.31                |
| 147 | Turkey                  | 30.80 | 29.77 | 29.47 | 29.38 | 29.14 | 32.33 | 30.21 | 27.65 | 28.03 | 27.33 | 27.45 | 27.43 | 31.34                |
| 148 | Uganda                  | 40.34 | 39.18 | 38.25 | 36.41 | 34.46 | 34.88 | 34.87 | 34.63 | 32.28 | 32.46 | 32.75 | 31.88 | 38.74                |
| 149 | Ukraine                 | 41.96 | 42.08 | 40.89 | 38.71 | 36.65 | 43.53 | 42.15 | 39.19 | 39.65 | 39.99 | 39.95 | 42.90 | 44.80                |
| 150 | United Arab<br>Emirates | 27.53 | 27.99 | 28.81 | 29.36 | 29.77 | 31.54 | 32.09 | 30.92 | 30.11 | 29.44 | 29.02 | 31.26 | 28.66                |
| 151 | United Kingdom          | 13.33 | 13.29 | 12.34 | 12.68 | 12.73 | 13.90 | 13.23 | 12.96 | 12.81 | 12.47 | 11.71 | 12.12 | 13.34                |

| No. | Country            | 2004  | 2005  | 2006  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | Av. over years |
|-----|--------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------------|
| 152 | United States      | 9.53  | 8.96  | 8.57  | 8.53  | 8.86  | 10.28 | 9.81  | 9.33  | 8.93  | 8.76  | 8.14  | 8.10  | 9.42           |
| 153 | Uruguay            | 45.74 | 44.93 | 44.92 | 42.94 | 40.20 | 40.72 | 38.32 | 36.68 | 37.25 | 37.49 | 35.59 | 37.38 | 45.67          |
| 154 | Venezuela, RB      | 33.81 | 30.65 | 29.76 | 29.15 | 28.73 | 32.75 | 31.10 | 30.25 | 29.72 | 29.34 | 30.25 | 31.23 | 31.41          |
| 155 | Vietnam            | 14.80 | 13.58 | 14.04 | 13.53 | 13.39 | 13.80 | 13.58 | 12.49 | 12.19 | 12.22 | 11.46 | 11.18 | 15.10          |
| 156 | Yemen, Rep.        | 24.38 | 23.46 | 23.18 | 23.29 | 23.31 | 22.94 | 23.57 | 32.07 | 31.98 | 31.07 | 27.61 | 28.81 | 28.34          |
| 157 | Zambia             | 47.60 | 49.01 | 48.52 | 45.54 | 43.22 | 42.17 | 34.47 | 36.61 | 33.38 | 30.83 | 30.72 | 32.99 | 45.32          |
| 158 | Zimbabwe           | 63.50 | 63.16 | 60.58 | 60.42 | 61.66 | 69.08 | 65.62 | 63.89 | 63.69 | 64.55 | 65.85 | 67.00 | 60.64          |
|     | Av. over countries | 32.18 | 31.64 | 30.80 | 30.02 | 29.59 | 31.26 | 30.13 | 29.49 | 29.07 | 28.87 | 28.25 | 28.68 | 32.28          |

Source: Own calculations.